We dedicate this book and its companion film to Jovia and all those African children, women and men who needlessly and prematurely suffer and die from cancer.

“I don’t want to leave you.”

Jovia
This Report — The State of Oncology in Africa 2015 — is a non-commercial, editorially independent piece of work which has been supported by the International Prevention Research Institute and the World Prevention Alliance and funded by an educational grant from Pfizer Inc., who had no role in determining the content or conclusions in the Report. The purpose is to educate and inform the scientific and lay communities and their political representatives about the status of cancer in Africa.

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The situation with cancer in Africa is critical. Global Society cannot, once again, react too slowly to an African health crisis.

Prof. Peter Boyle
"I am angry; we should all be angry."

Dr. Mamadou Diop
This is a call to African governments, foreign governments and international organizations to address the challenge posed by Cancer in Africa with specific, coordinated actions:

1. There is a need to train more oncologists and health professionals in cancer care and provide the necessary infrastructure which is urgently needed to identify and treat patients. More general and specialist surgical capacity is critical as are concomitant enhancements in imaging and pathology.
2. The drugs and equipment necessary to treat patients with cancer must be made available. As a minimum, each country should ensure the supply of all cancer drugs on the WHO Essential Medicines List. We need to deliver, install and maintain adequate numbers of resource appropriate Radiotherapy machines. It should be the right of cancer patients, no matter where they are to have access to the appropriate treatment of their disease.
3. Opioids must be available for controlling the pain of patients with terminal cancers (and other diseases). International Agencies should make this a priority activity and come to agreements with Governments of countries where these are not available.
4. Since half of cancer in Africa is currently caused by chronic infection, relevant infection control and vaccination programmes must be funded and implemented continent-wide.
5. Information and education campaigns to wipe out stigma and misinformation must be conceived and disseminated.
6. Making Universal Health Coverage globally available and strengthening health systems is critical for improving cancer care. This is also a critical area for the corporate and social responsibility agendas for the private industries including all trans-African corporations.
7. High quality cancer institutions, all over the world, should establish collaboration ventures with cancer centres and institutes in every African country, as well as with public health services.
8. International philanthropy is vital to help fund these efforts.
9. The United Nations International Covenant on Economic Social and Cultural Rights (ICESCR) should be invoked as the basis for action. This multilateral treaty provides that State Parties to the Covenant recognize the right of everyone to the enjoyment of the highest attainable standards of physical and mental health. Article 12.2 contains important determinants of the right to health such as prevention and treatment of diseases essential for the enjoyment of the right.
When this book, *The State of Oncology in Africa 2015*, was envisioned, the editors felt strongly that there was a part of Africa’s cancer battle which could not be done justice in print. The human side of efforts made by medical professionals, the agony of those without access to care or palliation needed to be told and shown on film. The idea of a full-length documentary companion film was born.

*Cancer is... Attacking Africa* was filmed in 2016 in various African countries, Europe and the United States. The film’s goal was to discover the human side of cancer, the pains and the joys, the efforts and the defeats, the ideas and the obstacles.

*Cancer is... Attacking Africa* features interviews with Africa’s leading cancer advocates, with doctors making their rounds in over-filled wards, or with Jovia, a cancer patient in her last days of life. It also features the opinions of academics and policy makers both in Africa and worldwide, who see a way forward, so long as the effort and resources are made available, sustainably.

This 90-minute television documentary was made possible by an unrestricted grant from Pfizer Inc. who had no influence on the film’s content or any contact with the film’s director prior to or during filming.

The film was directed by Cemil Alyanak. It was co-produced by Cemil Alyanak and Peter Boyle. Twalib Ngoma provided guidance and support, especially while the team was in Africa. The International Prevention Research Institute provided logistics and financial support as did the World Prevention Alliance. The production company was Excess Noise and the film’s narrator was Kim Lombard of Toronto, Canada.

The film is free for all to watch. Its goal is to spread knowledge and provide advocacy and fundraising support to all those who aim to combat cancer’s attack on Africa. The best place to view it is directly on the IPRI website at [www.i-pri.org](http://www.i-pri.org).

This film is the fifth in the Cancer is... series, the first two of which were introduced by President George H. W. Bush. At the time of writing, there are two further films planned focussing on cancer in India and neighbouring countries and Latin America and the Caribbean.
Because we lack data, the cancer situation in Africa may actually be worse than we thought.

Dr. Otis W. Brawley
Chapter 1

Introduction

Peter Boyle,* President, International Prevention Research Institute


Another volume to gather dust on a bookcase? Or a report which will generate action? I truly hope that this report contributes to the latter.

I have organised an annual meeting of leaders in Oncology since 2003. Initially, the attendees were directors of National Cancer Institutes and it became known as the National Cancer Institute Directors (NCID) meeting. Each year, more National Cancer Institute Directors came and the audience extended to national leaders in Oncology from countries where there was no National Cancer Institute. As time progressed, the participation from lower-resource countries increased. There are now over 100 participants each year with a majority from lower-resource countries.

The presentations revealed the day-to-day challenges faced in lower-resource countries and the huge difficulties in providing adequate care for so many patients with cancer. I wrote that cancer was increasingly a global issue (Boyle, 2006) and became increasingly aware of the enormous disparities which existed between countries and groups at different levels of deprivation, even within the same country (Boyle et al., 2008).

While preparing ‘The State of Oncology 2013’ (Boyle et al., 2013) and in the aftermath, I became increasingly aware that too few people were aware of these disparities and the critical situation in poor countries. Among international policy makers the attitude was that nothing could be done about chronic disease disparities since these low-resource countries were being ravaged by infectious disease. Even if it was possible to take action, how could something be done about cancer while diabetes and cardiovascular disease were also health threats? Hand wringing of the diplomatic sort.

In recent times, there have been various publications many of which focused on cancer statistics. Statistics tell us a lot about our world. Statistics tell us that the total number of cancers is increasing every year as the population grows and ages. This increase is compounded in Africa by the impact of the importation of cancer risk factors associated with western lifestyle. However, cancer is not a statistical disease: statistics are patients with the tears wiped away.

‘The State of Oncology in Africa 2015’ provides a unique assessment from the African perspective. It paints a depressing and shocking picture of the current situation: however, it reflects the reality in Africa. It demonstrates how too many patients do not seek, or cannot access, professional medical services. Those who do, do so when their cancer is at an advanced stage when cure is no longer possible. Africa suffers from a lack of oncologists in all disciplines, oncology nurses and the other necessary health professionals and technicians to conduct their work. There is a lack of treatment centres. There is a lack of treatments. Most countries do not have any radiotherapy equipment at all. Most countries do not have access to opioid drugs for palliative care and pain control. Most countries do not have the cancer drugs on the WHO Essential Medicines List.

The gap in cancer outcomes between high- and lower-resource countries continues to increase. Action is needed urgently to close this gap. Private public partnerships are to my mind the best way forward. Private investment has to lead, and then public action will follow. I am extremely impressed by the work the Gates Foundation has done in Africa and the PEPFAR programme. Concentrating on a single domain over a longer period appears essential to make a real impact.

Too many reports and volumes on global health end up unread and gathering dust on bookshelves. I hope and pray that this report has a different fate: lack of action now will impact on the fate of many thousands of cancer patients in Africa. The report will be made available without cost and can be downloaded from the website of the International Prevention Research Institute (www.i-pri.org).

The fight against cancer begins with knowledge and I encourage everyone to use these materials to build their personal understanding of the health of the world today. Do whatever you can to bring about change. Global Society cannot once again react too slowly to an African health crisis.

Chapter 2

Africa: Cancer Statistics

Otis W. Brawley, Lindsey A. Torre, Ahmedin Jemal


Africa is a vast and diverse continent comprised of 54 countries with an estimated 1.1 billion inhabitants. It is the second most populous continent with 13% of the world’s population (Fitzmaurice et al, 2015). The populations of Africa have diverse habits, customs, languages and religions. North Africa is predominantly Arab and Berber with Muslim influences. Sub-Saharan Africa has fifteen ethno-linguistic super groups with a number of religions. There are also pockets of people of European ancestry. Africa is commonly divided into five regions (Northern Africa and Eastern, Central, Southern, and Western Africa; the latter four form sub-Saharan Africa).

African Regions

Northern Africa: Algeria, Egypt, Libya, Morocco, Sudan, Tunisia, and Western Sahara

Eastern Africa: Burundi, Cameroon, Djibouti, Eritrea, Ethiopia, Kenya, La Reunion (France), Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Somalia, Tanzania, Uganda, Zambia, and Zimbabwe

Central Africa: Angola, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Equatorial Guinea, and Gabon

Southern Africa: Botswana, Lesotho, Namibia, Republic of South Africa, and Swaziland

Western Africa: Benin, Burkina Faso, Cape Verde, Cote d’Ivoire, Gambia, Ghana, Guinea-Bissau, Guinea, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo

Sub-Saharan Africa: refers to the combined Eastern, Central, Southern, and Western regions

Synopsis

The African population is growing faster than that of any other continent. It is set to double by 2050, when it is estimated to comprise 24% of the world’s population. By the end of the century, it will nearly quadruple and it is estimated that 40% of the world’s population will be from Africa (Parkin et al, 2014). The African population is also aging as it grows in size. The median age was 19.7 years in 2012 and is projected to increase to 25.4 years by 2050. Life expectancy for all Africans is currently 52 years, but varies considerably. It is estimated that African life...
expectancy will reach 65 years within the next two decades. (Torre et al, 2015). Figure 1 lists current life expectancy in each of the fifty-four countries compared to life expectancy in the Americas and Europe.

Most areas of Africa are undergoing westernization, including dietary changes, increasing obesity, increased dependence on automobiles, and decreased physical activity (Bray et al, 2012). Smoking rates are fairly low in most African countries, but there is a trend toward an increase in tobacco use, especially among men (Thun et al, 2014). Indeed, many tobacco companies view Africa as a place for growth in sales and much effort has been expended to promote tobacco use (van Walbeek, 2015).

There is much poverty in Africa and much of the population boom is occurring in the poorest and most fragile countries of western Africa such as Niger and Nigeria. GDP per capita varies 70 fold in Africa and is listed in Table 1 (Bray et al, 2012). In keeping with the widespread socioeconomic deprivation, medical resources are limited in much of Africa for all but a small upper class. Often quoted is the shortage of physicians qualified to treat cancer, but there is also a shortage of radiologists and pathologists needed to diagnose cancer as well as a shortage of diagnostic and radiation therapy equipment (Abdel-Wahab et al, 2013; Gopal et al, 2013; Kingham et al, 2013).

Table 1: 2014 Gross domestic product per capita

Source: International Monetary Fund World Economic Outlook (October 2014)

<table>
<thead>
<tr>
<th>Rank in Africa</th>
<th>Rank in World</th>
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<td>120</td>
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There are very few cancer registries and fewer countries keep vital statistics, which makes cancer burden assessment and resource allocation difficult (Parkin et al, 2014). There are now approximately thirty cancer registries covering a total of less than 4 percent of the population on the continent (Gakunga et al, 2015). Several have incidence data that is judged of high quality and are included in the International Agency for Research on Cancer publication Cancer in Five Continents, Volume X (Bay et al, 2015). The African registries also have limitations beyond existing in a medically scarce environment. Most are located in urban areas, while the majority of Africans live in rural environments. Several registries are also located in areas of significant social upheaval. Quality vital registration data in Africa is even scarcer than cancer registration. Of the 54 countries of Africa, 33 had no vital registration as of 2010-2012, while 18 had vital registration with very low performance (Mikkelsen et al, 2015).

The International Agency for Research on Cancer of the World Health Organization periodically publishes estimates of the worldwide cancer burden in GLOBOCAN. These include estimates of cancer incidence and mortality for the world regions and 184 countries or territories. The data sources and methods are described elsewhere (Jemal et al, 2012). However, the limited number of African registries means cancer incidence statistics for many areas of Africa are estimates derived from the registry data in neighbouring countries. In addition, most published African mortality data is estimated from estimated incidence data using the proportion of those diagnosed with cancer that die of their disease in areas with mortality data. Of the 54 African countries, estimates were based on data from neighbouring countries or regions for 20 countries for incidence and for 49 countries for mortality (Ferlay et al, 2012; Ferlay et al, 2015).

One should be cautious since much cancer incidence and mortality data are estimates derived from estimates. However, even with the limitations, the data produced provide a reasonable picture of the magnitude of the cancer problem and are useful for planning purposes (Ferlay et al, 2015). A separate estimate of global breast and cervical cancer rates using a different methodology suggested that Globocan underestimated incidence and mortality for these cancers (Forouzanfar et al, 2011).

The Number Diagnosed and Dying of Cancer

It is estimated that 847,000 Africans were diagnosed with cancer and 591,000 died of cancer in 2012. Eastern Africa had the largest number of cancer cases and deaths (Table 2). Overall, prostate cancer was the most commonly diagnosed cancer among African men, followed by liver and Kaposi’s Sarcoma (Table 3). The leading cause of cancer death among men was prostate, followed by liver and lung. Among women, the most commonly diagnosed cancer and the leading cause of cancer death was breast, followed by cervix and liver. Kaposi’s Sarcoma, prostate, and liver cancers were the most commonly diagnosed cancers among men by region, while breast and cervical cancers were the most commonly diagnosed among women (Table 4).

Table 2: Estimated total number of cancer cases by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Cases</th>
<th>Diagnosed</th>
<th>Overall</th>
<th>Deaths</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Africa</td>
<td>314,880</td>
<td>312,080</td>
<td>267,200</td>
<td>154,400</td>
<td>152,080</td>
</tr>
<tr>
<td>Central Africa</td>
<td>36,880</td>
<td>36,080</td>
<td>26,010</td>
<td>13,040</td>
<td>12,900</td>
</tr>
<tr>
<td>Western Africa</td>
<td>15,880</td>
<td>15,080</td>
<td>12,030</td>
<td>7,590</td>
<td>7,500</td>
</tr>
</tbody>
</table>

Table 3: Estimated number of cancers by type

<table>
<thead>
<tr>
<th>African men</th>
<th>Cases</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>57,916</td>
<td>42,020</td>
</tr>
<tr>
<td>Lung</td>
<td>39,716</td>
<td>27,040</td>
</tr>
<tr>
<td>Kaposi's Sarcoma</td>
<td>23,816</td>
<td>19,980</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>25,196</td>
<td>15,040</td>
</tr>
<tr>
<td>Bladder</td>
<td>25,716</td>
<td>14,140</td>
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<tr>
<td>Gastrointestinal</td>
<td>16,196</td>
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<tr>
<td>Skin</td>
<td>15,196</td>
<td>11,030</td>
</tr>
<tr>
<td>Bladder</td>
<td>10,216</td>
<td>9,400</td>
</tr>
<tr>
<td>Skin and soft tissue</td>
<td>30,000</td>
<td>27,510</td>
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</table>
Due to projected increases in the size of the population and the aging of that population alone, the number of cancer cases is projected to increase to 1.43 million total diagnoses and 1 million deaths by 2030 (Armitage et al, 1954; Sylla et al, 2012). This will put even greater burden on a continent that is already stressed by HIV, malaria, and tuberculosis. At the same time, Africa will also experience an increasing burden of other chronic diseases associated with tobacco smoking and westernization of diet and aging of the population, such as diabetes mellitus, cardiovascular disease, and orthopedic injury.

Estimates of lifetime risk of certain cancer diagnosis and lifetime risk of death for North Africa and Sub-Saharan Africa are shown in Figure 2. The ratio of diagnosis to death is 0.72 and 0.65 in each region, respectively (Parkin et al, 2014).
The State of Oncology in Africa – 2015

Chapter 2 – Africa: Cancer Statistics

Cancer Rates by Region

Age-adjusted cancer rates are relatively low in Africa compared to other continents (Figure 3). Cancer is the second leading cause of death worldwide accounting for 14.7% of all deaths. It is the second leading cause of death in North Africa, accounting for 12.4% of all deaths. It is currently sixth in sub-Saharan Africa, causing 4.4% of all deaths (Table 5).

![North Africa Risk of Cancer Diagnosis and Risk of Cancer Death to age 74](image)

Age-standardized Cancer Incidence and Mortality Rates by Sex and World Region 2012

![Age-standardized Cancer Incidence and Mortality Rates by Sex and World Region 2012](image)

Table 5: Leading causes of death worldwide and in Africa, sub-Saharan Africa, and Northern Africa, 2012 (thousands)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Deaths</th>
<th>%</th>
<th>Rank</th>
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<td>HIV/AIDS</td>
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<td>41</td>
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<td>2</td>
<td>1,400</td>
<td>13.1</td>
<td>4</td>
<td>959</td>
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<td>1</td>
<td>440</td>
<td>42.7</td>
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<td>17,513</td>
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<td>3</td>
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<td>10.7</td>
<td>3</td>
<td>1,106</td>
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<td>14</td>
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<td>12</td>
<td>7</td>
<td>0.7</td>
<td>12</td>
<td>119</td>
</tr>
</tbody>
</table>


Figure 2: North Africa Risk of Cancer Diagnosis and Risk of Cancer Death to age 74

Figure 3: Age-standardized cancer incidence and mortality rates by gender and world region, 2012

Cancer rates vary substantially by region. Among men, the highest incidence rates are for prostate cancer in Southern, Central, and Western Africa, Kaposis Sarcoma in Eastern Africa, and liver cancer in Northern Africa (Table 6). Among women, the highest incidence rates are for breast cancer in Southern, Northern, and Western Africa, and cervical cancer in Eastern and Central Africa. The highest mortality rates for men were for prostate cancer in Central Africa, liver cancer in Northern and Western Africa, Kaposis Sarcoma in Eastern Africa, and lung cancer in Southern Africa (Table 7). Among women, the highest mortality rates were for cervical cancer in Southern, Eastern, and Central Africa and breast cancer in Northern and Western Africa.

Table 6: Age-adjusted incidence rates* for the most common cancers in Africa, by gender, 2012


<table>
<thead>
<tr>
<th>Africa</th>
<th>Sub-Saharan Africa*</th>
<th>Northern Africa*</th>
<th>World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank</td>
<td>Deaths</td>
<td>Rank</td>
<td>Deaths</td>
</tr>
<tr>
<td>Pregnancy-related</td>
<td>9</td>
<td>128 (21)</td>
<td>10 (18)</td>
</tr>
<tr>
<td>Sub-Saharan</td>
<td>10</td>
<td>1,276 (21)</td>
<td>12 (17)</td>
</tr>
<tr>
<td>(Africa)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endemic regions</td>
<td>11</td>
<td>124 (21)</td>
<td>7 (12)</td>
</tr>
<tr>
<td>Non-endemic</td>
<td>12</td>
<td>186 (3)</td>
<td>11 (18)</td>
</tr>
<tr>
<td>cancers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LMICs</td>
<td>13</td>
<td>156 (1.6)</td>
<td>18 (13)</td>
</tr>
<tr>
<td>High Incidence</td>
<td>14</td>
<td>18 (0.3)</td>
<td>12 (34)</td>
</tr>
<tr>
<td>Sub-Saharan</td>
<td>15</td>
<td>16 (4)</td>
<td>15 (30)</td>
</tr>
<tr>
<td>(Africa)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other regions</td>
<td>16</td>
<td>23 (0.2)</td>
<td>17 (11)</td>
</tr>
<tr>
<td>Sub-Saharan</td>
<td>17</td>
<td>0.0 (0.0)</td>
<td>18 (8)</td>
</tr>
<tr>
<td>(Africa)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>108.9 (10.4)</td>
<td>108.9 (10.4)</td>
</tr>
</tbody>
</table>

* Countries are grouped according to the regional groupings used by the United Nations for reporting progress toward the Millennium Development Goals (http://mdgs.un.org/unsd/mdg/Host.aspx?Conten=C/RegionalGroupings.htm)

** Excluding HIV/AIDS

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The State of Oncology in Africa – 2015

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A Note About Age Adjustment

Age is a key determinant of risk of developing every type of cancer (Armitage et al, 1954). Age distribution varies widely from country to country. Crude incidence or mortality rates do not take into account the varying age structures in the underlying populations. Comparisons of incidence rates must be made independent of the effects of age in order to be meaningful. Age adjustment, referring to a common standard population, allows for comparisons of incidence across populations and within the same population over time.

The age adjusted rates presented in this chapter use the World Standard Population first introduced by Segi in 1960 and drawn from a pooled population of 46 countries and modified by Doll in 1966. This is commonly referred to as the Segi–Doll world standard (Bray et al, 2002).

Age specific analysis may provide insight into the biology and aetiology of cancer in the specific population or populations under study.

Cancer Rates by Country

Among women, the most common cancers by country include breast (26 countries) and cervix (28) (Figure 4, Table 8). Among men, however, there is considerable variation, with the most common cancer by country including prostate (23 countries), liver (13), Kaposi’s Sarcoma (6), lung (5), colorectal (2), non-Hodgkin lymphoma (2), oesophagus (1), leukaemia (1), and stomach (1). Table 8 also details estimates of the years of life lost due to cancer, risk of a cancer diagnosis by age 75, and the prevalence of adult cancer survivors per 100,000.

### Table 7: Age-adjusted mortality rates* for the most common cancers in Africa, by gender, 2012


#### Men

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Africa</th>
<th>Sub-Saharan Africa</th>
<th>Southern Africa</th>
<th>Eastern Africa</th>
<th>Central Africa</th>
<th>Northern Africa</th>
<th>Western Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank</td>
<td>Rate</td>
<td>Rank</td>
<td>Rate</td>
<td>Rank</td>
<td>Rate</td>
<td>Rank</td>
<td>Rate</td>
</tr>
<tr>
<td>All cancers excl. skin cancer</td>
<td>92.9</td>
<td>98.4</td>
<td>101.5</td>
<td>102.8</td>
<td>82.3</td>
<td>99.9</td>
<td>85.3</td>
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<td>21.5</td>
<td>1</td>
<td>24.4</td>
<td>1</td>
<td>24.2</td>
<td>1</td>
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<tr>
<td>Prostate</td>
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<td>17.9</td>
<td>2</td>
<td>17.9</td>
<td>2</td>
<td>17.9</td>
<td>2</td>
</tr>
<tr>
<td>Liver</td>
<td>3</td>
<td>13.7</td>
<td>4</td>
<td>12.1</td>
<td>5</td>
<td>11.3</td>
<td>6</td>
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<tr>
<td>Stomach</td>
<td>4</td>
<td>9.7</td>
<td>6</td>
<td>9.7</td>
<td>7</td>
<td>9.7</td>
<td>8</td>
</tr>
<tr>
<td>Kaposi sarcoma</td>
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<td>7.6</td>
<td>7</td>
<td>7.6</td>
<td>8</td>
<td>7.6</td>
<td>9</td>
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<td>Lung</td>
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<td>8</td>
<td>6.2</td>
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<td>4.2</td>
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<td>4.1</td>
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<tr>
<td>Non-Hodgkin lymphoma</td>
<td>8</td>
<td>4.6</td>
<td>10</td>
<td>4.2</td>
<td>11</td>
<td>4.2</td>
<td>12</td>
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<td>3.7</td>
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<tr>
<td>Oesophagus</td>
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<td>12</td>
<td>3.6</td>
<td>13</td>
<td>3.6</td>
<td>14</td>
</tr>
<tr>
<td>Leukaemia</td>
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<td>3.1</td>
<td>13</td>
<td>2.9</td>
<td>14</td>
<td>2.8</td>
<td>15</td>
</tr>
<tr>
<td>Stomach</td>
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<td>2.7</td>
<td>14</td>
<td>2.6</td>
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#### Women

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<tr>
<th>Cancer Site</th>
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<th>Southern Africa</th>
<th>Eastern Africa</th>
<th>Central Africa</th>
<th>Northern Africa</th>
<th>Western Africa</th>
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<tbody>
<tr>
<td>Rank</td>
<td>Rate</td>
<td>Rank</td>
<td>Rate</td>
<td>Rank</td>
<td>Rate</td>
<td>Rank</td>
<td>Rate</td>
</tr>
<tr>
<td>All cancers excl. skin cancer</td>
<td>88.7</td>
<td>93.0</td>
<td>98.7</td>
<td>103.5</td>
<td>83.1</td>
<td>75.7</td>
<td>75.7</td>
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<td>3</td>
<td>17.3</td>
<td>5</td>
<td>17.3</td>
<td>7</td>
</tr>
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<td>Cervix uteri</td>
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<td>17.2</td>
<td>4</td>
<td>17.2</td>
<td>6</td>
<td>17.2</td>
<td>8</td>
</tr>
<tr>
<td>Liver</td>
<td>3</td>
<td>16.8</td>
<td>5</td>
<td>16.8</td>
<td>7</td>
<td>16.8</td>
<td>9</td>
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<td>6</td>
<td>15.8</td>
<td>8</td>
<td>15.8</td>
<td>10</td>
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<tr>
<td>Non-Hodgkin lymphoma</td>
<td>5</td>
<td>15.6</td>
<td>7</td>
<td>15.6</td>
<td>9</td>
<td>15.6</td>
<td>11</td>
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<tr>
<td>Kaposi sarcoma</td>
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<td>8</td>
<td>14.8</td>
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<td>14.8</td>
<td>12</td>
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<tr>
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<td>14.2</td>
<td>9</td>
<td>14.2</td>
<td>11</td>
<td>14.2</td>
<td>13</td>
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<td>13.7</td>
<td>10</td>
<td>13.7</td>
<td>12</td>
<td>13.7</td>
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<td>12.9</td>
<td>15</td>
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<td>12.3</td>
<td>12</td>
<td>12.3</td>
<td>14</td>
<td>12.3</td>
<td>16</td>
</tr>
</tbody>
</table>

* Rates are per 100,000 and age-standardized to the world standard population.
Chapter 2 – African Cancer Statistics

Africa: Most Common Cancers - Men

- Colorectum
- Esophagus
- Kaposi’s Sarcoma
- Leukemia
- Liver
- Lung
- Non-Hodgkin Lymphoma
- Prostate
- Stomach

2012

Figure 4a: Most common cancer sites in Africa, Men, 2012

Africa: Most Common Cancers - Women

- Breast
- Cervix uteri

2012

Figure 4b: Most common cancer sites in Africa, Women, 2012
Table 8: Cancer statistics in African Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Most commonly diagnosed cancer, men (estimated 2012)</th>
<th>Most commonly diagnosed cancer, women (estimated 2012)</th>
<th>Years of life lost to cancer (15 years and older), 2012</th>
<th>Cancer incidence by age 75</th>
<th>Prevalence of cancer survivors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mauritania</td>
<td>Lung</td>
<td>Brain</td>
<td>2,131</td>
<td>12.6</td>
<td>322.7</td>
</tr>
<tr>
<td>Angola</td>
<td>Malortre</td>
<td></td>
<td>1,860</td>
<td>18.6</td>
<td>386</td>
</tr>
<tr>
<td>Mali</td>
<td>Lung</td>
<td>Brain</td>
<td>2,157</td>
<td>13.6</td>
<td>271.1</td>
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<td>Brain</td>
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<td>Brain</td>
<td>2,034</td>
<td>14.6</td>
<td>337.2</td>
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<td>Brain</td>
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<td>363</td>
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<td>Brain</td>
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<td>7.5</td>
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<td>Brain</td>
<td>2,109</td>
<td>7.9</td>
<td>193.2</td>
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<td>Benin</td>
<td>Lung</td>
<td>Brain</td>
<td>2,203</td>
<td>10.7</td>
<td>279</td>
</tr>
<tr>
<td>Cape Verde</td>
<td>Lung</td>
<td>Brain</td>
<td>2,267</td>
<td>12.2</td>
<td>195</td>
</tr>
<tr>
<td>Democratic Republic of Congo</td>
<td>Lung</td>
<td>Brain</td>
<td>2,226</td>
<td>12</td>
<td>287.9</td>
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<td>Brain</td>
<td>1,522</td>
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<td>114</td>
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<td>Brain</td>
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<td>15.6</td>
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<td>Brain</td>
<td>2,258</td>
<td>9.7</td>
<td>287.3</td>
</tr>
<tr>
<td>Gambia</td>
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<td>Brain</td>
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<td>Guinea</td>
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<td>Brain</td>
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<td>2,099</td>
<td>8.5</td>
<td>170.5</td>
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</table>

For a comprehensive list of African countries and their cancer statistics, refer to the table above. The statistics include the most commonly diagnosed cancer among men and women, years of life lost to cancer, and prevalence of cancer survivors. The data is estimated for the year 2012. The table covers various countries in Africa, each listed under its respective name.

The State of Oncology in Africa – 2015

Chapter 2 - Cancer Statistics

African Cancer Statistics

<table>
<thead>
<tr>
<th>Country</th>
<th>Most commonly diagnosed cancer, men (estimated 2012)</th>
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<th>Years of life lost to cancer (15 years and older), 2012</th>
<th>Cancer incidence by age 75</th>
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<td>Benin</td>
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All-sites cancer incidence rates (per 100,000 population) among men range from 56.7 in Niger to 242.5 in La Réunion (Table 9). All-sites cancer mortality rates among men range from 50.0 in Cape Verde to 152.7 in Uganda. Among women, incidence rates range from 69.6 in the Gambia to 209.1 in Zimbabwe, while mortality rates range from 45.5 in Namibia to 146.5 in Zimbabwe.
Breast cancer is the most commonly diagnosed cancer and the leading cause of cancer death among women in Africa as a whole. It is the leading cancer diagnosed in North Africa and the leading cancer diagnosed in many Sub-Saharan countries. Breast cancer incidence rates (per 100,000 women) in Africa range from 9.0 in Lesotho to 64.2 in Mauritius, while mortality rates range from 4.4 in Lesotho to 25.9 in Nigeria (Table 10). Rates of breast cancer appear to be increasing due to increases in the prevalence of risk factors such as early menarche, late child bearing, having fewer children, and obesity, in addition to the effects of increased awareness and detection (Parkin et al, 2014).

Table 9: Cancer incidence and mortality by country of Africa

<table>
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<th>Country</th>
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<th>All cancers mortality (excluding non-melanoma skin cancers), men</th>
<th>All cancers incidence (excluding non-melanoma skin cancers), women</th>
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Source information:
Table 10: Breast cancer incidence and mortality and cervical cancer incidence

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Cervical cancer is the second most commonly diagnosed cancer and the second leading cause of cancer death in African women as a whole, but rates vary across the continent. Cervical cancer rates are lower in North Africa compared with sub-Saharan Africa (Tables 6 and 7). Cervical cancer incidence and mortality rates (per 100,000 population) range from 2.3 and 1.0, respectively, in Egypt to 75.9 and 49.8 in Malawi (Table 10). Variation in cervical cancer incidence is primarily due to both underlying prevalence of oncogenic HPV infection as well as availability of screening (Forman et al., 2012).

Table 11: Prostate cancer incidence and mortality

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Source information:
Lung cancer is the fourth most commonly diagnosed cancer and the third leading cause of cancer death in African men, but it is not among the top ten cancers for African women (Table 12). Among men, it is among the top two most common cancers only for the regions of Northern and Southern Africa (Table 4). Table 12 is the estimates of incidence for lung cancer in men and in women by country. Lung cancer rates are expected to increase in Africa (Parkin et al., 2014). Tobacco use is a major cause of lung cancer, but exposure to environmental smoke due to cooking and heating is a major factor in lung cancer development, especially among women (Mortimer et al., 2012). In Africa, an estimated 23% of lung cancer deaths among women are attributed to household air pollution from solid fuels (Institute for Health Metrics and Evaluation, 2015).

### Table 12. Lung cancer incidence

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<th>Country</th>
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Lung cancer is the fifth most common cancer and leading cause of cancer death among men, and the fourth among women (Table 3). Rates are highest in Southern Africa (Tables 6 and 7), and several Northern countries including Libya, Algeria, and Tunisia also have among the highest rates. Colorectal cancer was once rare in Africa, but rates in many countries have increased with increasing sedentary lifestyles and dietary transitions (Parkin et al, 2014).

Oesophageal cancer is the eighth most commonly diagnosed cancer and the seventh leading cause of cancer death among African men and women (Table 3). It is the most commonly diagnosed cancer among men in Botswana. Incidence rates in Southern and Eastern Africa are among the highest in the world, while those in Northern and Western Africa are among the lowest (Torre et al, 2015). The causes of oesophageal cancer in Africa are poorly understood, but are thought to include alcohol, diet, and fungal contamination of maize (Jemal et al, 2012).

Liver cancer is the second most common cancer and leading cause of cancer death among men, and the third among women (Table 3). Rates in Northern and Western Africa are among the highest in the world (Torre et al, 2015). The high rates in Africa are primarily due to the high prevalence of hepatitis B infection, although foods contaminated with aflatoxin also play a role.

Table 13 is the five-year net survival percentages for selected cancers among adults aged 15 years of age and older, in select countries, 2005-2009. This data is drawn from several African registries. There are definite limitations to the reliability of this data.
Table 13: Five-year net survival rates* (%) for selected cancers among adults 15 years of age and older in select countries, 2005-2009


Available at http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)62038-9/abstract

<table>
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<th>Stomach</th>
<th>Colon</th>
<th>Rectum</th>
<th>Liver</th>
<th>Lung</th>
<th>Breast (women)</th>
<th>Cervix</th>
<th>Ovary</th>
<th>Prostate</th>
<th>Leukaemia</th>
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<td>52</td>
<td>37</td>
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*Survival rates are age-standardized.
1*Data are subject to limitations. Please see source.

Childhood Cancers

Compared to Africa, childhood cancer rates are higher in developed countries where it is the second leading cause of death in children. The actual incidence and mortality rates in Africa are not known, but they are certainly not among the ten most common causes of death. There are areas with high rates of Burkitt's lymphoma and Kaposi's Sarcoma in children (Parkin et al, 2014). These are diseases almost unheard of in North America and Europe. There are also anecdotal reports of high incidence of retinoblastoma in some countries of sub-Saharan Africa (Zambia, Zimbabwe and Congo) (Parkin et al, 2014). In a survey of cancer treatment facilities the proportion of cancers occurring in children varied from 1.4% of all cases in a Ghanaian facility to 100% in a Rwandan facility (Parkin et al, 2014).

Nephroblastoma appears to be the most common solid tumour in children in all of Africa, exceeding 10% of total paediatric cancers in many countries (Rwanda 21.3%, Senegal 22%, Cote d'Ivoire 14.3%, Mali 17.6%, Congo 15.5%, etc.) (Stefan, 2015). In Mozambique and Uganda, Kaposi's Sarcoma was the most common childhood cancer in children (15.8% and 22.0% of all cases respectively) and it was the second most common cancer in children in Zambia (15.6%) and Malawi (12.4%) (Mukibi et al, 1995).

Non-Hodgkin lymphoma was the most common childhood cancer in West Africa: Ghana (53.6%), Cote d'Ivoire (73.6%) and Mali (32.7%). In Eastern Africa, two Kenyan centres reported Burkitt’s lymphoma as the most common tumour (25.1 and 37.1%, respectively). In the Congo, retinoblastoma was the most common childhood cancer with an incidence of 20.1% (Kruger et al, 2014).

The South African Children’s Tumour Registry is not population based and likely an underestimate of the problem in South Africa. In a ten year period from 1997 to 2007, it produced an overall incidence rate which is a third that of the United States or Europe. The most commonly diagnosed cancers among children were leukaemia (25.4%), lymphoma (13.5%), brain tumours (13.5%), nephroblastoma (12.3%), soft tissue sarcoma (9.5%), and retinoblastoma (7.1%) (Kruger et al, 2014).

Cancer Risk Factors

Many cancer risk factors common in western countries such as tobacco use, physical inactivity, and excess body weight are increasing in many African countries. At the same time, infection remains an important cause of cancer in Africa. It is estimated that infections cause 33% of cancers in sub-Saharan Africa and 13% of cancers in North Africa (de Martel et al, 2012). In comparison, infection is thought to cause 7% and 4% of cancers in Europe and North America, respectively. It is well known that H. pylori is linked to gastric cancer; Hepatitis B and C viruses cause hepatocellular carcinoma and human papillomavirus causes cervical, anal, and certain head and neck cancers. Less appreciated is the fact that Burkitt’s lymphoma is thought to be caused by chronic inflammation due to falciform malaria and squamous cell cancer of the bladder common in Egypt is caused by schistosomiasis (Molyneux et al, 2012; Mostafa et al, 1999). Aflatoxin found in dietary grain and produced by the aspergillus species of mould is also a cause of liver cancer: HIV infection is linked to lymphoma, Kaposi’s Sarcoma and a number of other cancers (Sasco et al, 2010). While tobacco smoking is generally less common in Africa than elsewhere in the world, it is more common in some countries, especially in Northern Africa and among men, and is said to be increasing (Table 14). The use of solid fuels for heating and cooking, the source of indoor air pollution, is common in many African countries. This is a significant cause of respiratory disease and lung cancer in Africa and especially in women (Table 15). Mortimer et al, 2012). Excess body weight is also increasing in Africa, although many African countries still have the lowest percentages of overweight people worldwide. In South Africa and several Northern African countries, 50% or more of adults are overweight or obese (Table 16).
Table 15: Percentage of population using solid fuels 2010


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## Solid Fuels

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</table>

## Table 16: Proportion of population overweight


<table>
<thead>
<tr>
<th>Country</th>
<th>Overweight prevalence, adult men</th>
<th>Overweight prevalence, adult women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>41.8</td>
<td>54.6</td>
</tr>
<tr>
<td>Angola</td>
<td>20.4</td>
<td>30.7</td>
</tr>
<tr>
<td>Benin</td>
<td>20.4</td>
<td>31.0</td>
</tr>
<tr>
<td>Botswana</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Burkina</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Burundi</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Comoros</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Democratic Republic Congo</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Eritrea</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Madagascar</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Malawi</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Mauritania</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Mozambique</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Namibia</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Nigeria</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Reunion</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Senegal</td>
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<td>58.0</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Somalia</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>South Africa</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Swaziland</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Tanzania</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Togo</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Togo</td>
<td>35.0</td>
<td>58.0</td>
</tr>
<tr>
<td>Western Sahara</td>
<td>35.0</td>
<td>58.0</td>
</tr>
</tbody>
</table>
African Cancer Registries

There are eight registries with data included in the recent publication Cancer Incidence in Five Continents. These registries have been judged to produce high-quality data.

The Sétif Population-based Cancer Registry, Sétif, Algeria

The Sétif Population-based Cancer Registry covers Sétif, a province in the Arab-Islamic North African country of Algeria. It covers approximately 1.5 million people, which is 4.7% of the Algerian population. The population is relatively young (with 63% aged less than 30 years and 6.4% aged 60 years or more). Approximately half live in urban areas. The registry is population based. The registry is based within Sétif University. It uses active case finding from 16 data sources. These consist of public and private hospitals, laboratories, insurance offices, other cancer registries, and death registration offices. Data are cross-checked to assure accuracy (Hamdi Cherif et al, 2014; Zanetti et al, 2010) (Table 17).

| Table 17: Age-adjusted incidence rate of cancer (world standard) in selected area in Africa: Sétif, Algeria

<table>
<thead>
<tr>
<th>Country</th>
<th>Overweight prevalence, adult men</th>
<th>Overweight prevalence, adult women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sétif, Algeria</td>
<td>19.9</td>
<td>20.8</td>
</tr>
</tbody>
</table>

The Gharbiah Population-based Cancer Registry, Gharbiah, Egypt

The Gharbiah Population-based Cancer Registry covers eight districts within the Gharbiah Governorate (Tanta, Elmahalla Elkobra, Kaf Elzayat, Zeitra, Kotour, Elbanta, Basouan, and Samannoud) in the Nile Delta region of Egypt. It covers approximately 4 million, accounting for 5.5% of the overall population of Egypt. About 30% of residents live in urban areas. The registry is based in the Tanta Cancer Centre in Gharbiah. It utilizes active case finding from 63 data sources (Dey et al, 2011) (Table 18).

| Table 18: Age-adjusted incidence rate of cancer (world standard) in selected area in Africa: Gharbiah, Egypt

| Gharbiah, Egypt - 10 Major cancers, ASR (world) per 100,000 |
|-----------------|-----------------|-----------------|
| **Men** | **Women** | **Men** | **Women** |
| Liver | 24.6 | Breast | 6.4 |
| Non-Hodgkin lymphoma | 16.1 | Larynx | 6.7 |
| Bladder, bladder and urolithiasis | 12.7 | Cervix uteri | 5.1 |
| Prostate | 14.7 | Uterus unspecified | 6.0 |
| Other and unspecified | 9.1 | Other and unspecified | 4.1 |
| Thoracic | 4.1 | Thoracic, bronchus and lung | 3.7 |
| Non-melanoma skin cancer | 2.7 | Cerebral | 3.6 |
| Colon, rectum, colon and rectum | 2.6 | Colon | 3.4 |
| Skin | 2.6 | Skin | 3.2 |
| All sites | 19.6 | All sites | 12.1 |

The Benghazi Cancer Registry, Benghazi, Libya

The Benghazi Cancer Registry covers eight districts in the eastern part of Libya (Tolbuk, Derma, Bayda, Al Majr, Benghazi, Ajabliya, Al Waht, and Al Kufr). The population covered is approximately 1.6 million, which is 28% of the total population of Libya. The registry is located within the Medical School of Benghazi University. The registry uses active case finding from cancer service units, general and regional hospitals, university hospitals, private hospitals and clinics, specialized hospitals and centres outside the region, and pathology laboratories. Death certificates are actively investigated. (El Mistiri et al, 2015) (Table 19).

| Table 19: Age-adjusted incidence rate of cancer (world standard) in selected area in Africa: Benghazi, Libya

| Benghazi, Libya - 10 Major cancers, ASR (world) per 100,000 |
|-----------------|-----------------|-----------------|
| **Men** | **Women** | **Men** | **Women** |
| Liver | 28.9 | Breast | 11.8 |
| Non-Hodgkin lymphoma | 14.9 | Colon | 8.3 |
| Bladder, bladder and urolithiasis | 10.4 | Cervix uteri | 8.1 |
| Prostate | 8.8 | Other and unspecified | 4.9 |
| Non-Hodgkin lymphoma | 5.8 | Uterus unspecified | 4.7 |
| Other and unspecified | 5.5 | Other and unspecified | 4.6 |
| Thoracic | 5.4 | Thoracic, bronchus and lung | 4.1 |

The State of Oncology in Africa - 2015
### Table 21: Age-adjusted incidence rate of cancer (world standard) in selected area in Africa: PROMEC, Transkei, South Africa

<table>
<thead>
<tr>
<th>PROMEC, South Africa 10 Major cancers, ASR (world) per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
</tr>
<tr>
<td>Brain, nervous system</td>
</tr>
<tr>
<td>Prostate</td>
</tr>
<tr>
<td>Rectum, rectosigmoid, and anal</td>
</tr>
<tr>
<td>Other and unspecified</td>
</tr>
<tr>
<td>Oesophagus</td>
</tr>
<tr>
<td>Esophagean, aerodigestive and anal</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
</tr>
<tr>
<td>Non-melanoma skin cancer</td>
</tr>
<tr>
<td>Non-melanoma skin cancer</td>
</tr>
<tr>
<td>All sites</td>
</tr>
</tbody>
</table>

The PROMEC Registry, Transkei, South Africa

The PROMEC Cancer Registry operates in the rural Transkei region of the South African province of the Eastern Cape. The registry covers the population of eight magisterial areas: Butterworth, Centane (Kentani), Idutywa, Nqamakwe, Wilkowdale, Bizana, Flagstaff, and Lusikisiki. The vast majority of residents are Black Africans and speak isiXhosa. The PROMEC Cancer Registry collaborates with 19 hospitals and one state laboratory. Case finding is performed both passively and actively (Somdyala et al, 2003). Data are shown in Table 21.

### Table 22: Age-adjusted incidence rate of cancer (world standard) in selected area in Africa: North Tunisia

<table>
<thead>
<tr>
<th>North Tunisia 10 Major cancers, ASR (world) per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
</tr>
<tr>
<td>Brain, nervous system</td>
</tr>
<tr>
<td>Prostate</td>
</tr>
<tr>
<td>Rectum, rectosigmoid, and anal</td>
</tr>
<tr>
<td>Other and unspecified</td>
</tr>
<tr>
<td>Oesophagus</td>
</tr>
<tr>
<td>Esophagean, aerodigestive and anal</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
</tr>
<tr>
<td>Non-melanoma skin cancer</td>
</tr>
<tr>
<td>Non-melanoma skin cancer</td>
</tr>
<tr>
<td>All sites</td>
</tr>
</tbody>
</table>

The Cancer Registry of North Tunisia, Tunisia

The Cancer Registry of North Tunisia covers 11 provinces in the northern area of the country (28,000 km²). The covered area includes urban regions such as the cities of Tunis, Bizerte, and Nabeul. Farming and fishing are the main occupations in the rural areas of the region. The region is mainly Arabic and Islamic. The registry collects data actively from 85 healthcare sources both public and private (Missaoui et al, 2012). (Table 22)
### The Kampaia Cancer Registry, Kyadondo County, Uganda

The Kampaia Cancer Registry covers the population of Kyadondo County, which includes the city of Kampaia and a semi-urban area. The majority of the population is of the Ganda ethnic group. The registry is based in the Department of Pathology at the Makerere University College of Health Sciences. Registration is primarily through active case finding. Registrars visit hospitals, hospices, and histopathology laboratories regularly. Death certificates are incomplete and therefore not used as a source of information by the registry (Wabinga et al, 2014).

### The Zimbabwe National Cancer Registry, Harare, Zimbabwe

The Zimbabwe National Cancer Registry became population-based in 1990. It covers approximately 1.4 million residents. Active case finding is carried out through visits to health care facilities. There are routine visits to the central referral hospitals, searching of medical records of discharged and deceased cancer patients, visits to oncology outpatient clinics, and review of histology reports from the public and private sectors.

### Table 23: Age-adjusted incidence rate of cancer (world standard) in selected area in Africa: Kyadondo, Uganda

<table>
<thead>
<tr>
<th>Kyadondo, Uganda 10 Major cancers, ASR (world) per 100,000</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All sites</strong></td>
<td>23.5</td>
<td>5.6</td>
</tr>
<tr>
<td>Breast</td>
<td>16.7</td>
<td>11.5</td>
</tr>
<tr>
<td>Colon</td>
<td>13.9</td>
<td>8.8</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>7.7</td>
<td>6.4</td>
</tr>
<tr>
<td>Oesophagus</td>
<td>8.8</td>
<td>8.1</td>
</tr>
<tr>
<td>Liver</td>
<td>4.1</td>
<td>4.9</td>
</tr>
<tr>
<td>Cervix uteri</td>
<td>3.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Trachea, bronchus and lung</td>
<td>10.0</td>
<td>8.8</td>
</tr>
<tr>
<td>Kaposi’s Sarcoma</td>
<td>10.9</td>
<td>8.8</td>
</tr>
<tr>
<td>Prostate</td>
<td>10.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Bladder</td>
<td>32.9</td>
<td>33.9</td>
</tr>
<tr>
<td><strong>All sites</strong></td>
<td>299.5</td>
<td>33.9</td>
</tr>
</tbody>
</table>

### Table 24: Age-adjusted incidence rate of cancer (world standard) in selected area in Africa: Harare, Zimbabwe

<table>
<thead>
<tr>
<th>Harare, Zimbabwe 10 Major cancers, ASR (world) per 100,000</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All sites</strong></td>
<td>246.1</td>
<td>291.0</td>
</tr>
<tr>
<td>Breast</td>
<td>31.7</td>
<td>14.2</td>
</tr>
<tr>
<td>Trachea, bronchus and lung</td>
<td>18.1</td>
<td>15.9</td>
</tr>
<tr>
<td>Bladder</td>
<td>17.4</td>
<td>15.9</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>8.0</td>
<td>10.8</td>
</tr>
<tr>
<td>Liver</td>
<td>6.0</td>
<td>6.7</td>
</tr>
<tr>
<td>Cervix uteri</td>
<td>214.9</td>
<td>13.9</td>
</tr>
<tr>
<td>Corpus uteri</td>
<td>15.6</td>
<td>37.3</td>
</tr>
<tr>
<td><strong>All sites</strong></td>
<td>11.5</td>
<td>9.4</td>
</tr>
</tbody>
</table>

### References


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The State of Oncology in Africa - 2015

Chapter 2  Africa Cancer Statistics
The State of Oncology in Africa - 2015

The State of Oncology in Africa – 2015


Why is Good Cancer Pathology Needed in Sub-Saharan Africa?

The above scene, played out daily in many nations around the globe, is most dire in less developed countries (including Sub-Saharan Africa; SSA) where pathology and histology from medical school but there was no one within 100 km to whom he could send a biopsy for diagnosis. Because she was only 38, he didn’t want to have the surgeon (who was about 60 km away) simply remove her breast with no further treatment available. But what if it was benign? If he told her to watch the mass, she may return in a few months with tumour in her axilla. He stepped out of the room for a moment to ask his nurse a question and noticed a row of women and a few men all sitting on the bench waiting to be seen, several with obvious lumps and masses for which he would, again, have no answer. The above scene, played out daily in many nations around the globe, is most dire in less developed countries (including Sub-Saharan Africa, SSA) and often, late-stage cases are presenting even later. It illustrates the fact that, in the absence of access to good pathology, clinicians are often left treating patients without an accurate diagnosis, which leads to inappropriate therapy in a significant proportion of their patients.

Global health efforts over the past quarter century have improved quality and length of life in many countries. Across SSA highly prevalent infections such as tuberculosis, HIV, malaria and other tropical diseases are being detected and treated, lowering the infectious disease burden. For example, between 2000 and 2015, malaria incidence rates fell by 42% and mortality rates fell by 66% in Africa, thanks to substantial strategic investment by many agencies (World Malaria Report, 2015). As a consequence, the relative burden of non-communicable diseases (NCDs), including diabetes, hypertension and especially cancer is increasing (Ferlay et al., 2012). The latter is also increasing because of increasing longevity, including long-term HIV survivors (Adamamow et al., 2014). With respect to pathology and laboratory medicine needs, cancer is very different from diseases such as malaria, tuberculosis, or HIV (in which a very limited number of low complexity laboratory tests and
a specific drug regimen alleviates a huge burden of disease. In contrast, cancer is a complex disease that requires a health system to manage adequately.

In this chapter we define pathology as cellular or anatomic pathology (including cytology); i.e., morphological assessment of tissue. Pathology has many sub-disciplines; cellular pathology, haematology, microbiology, clinical chemistry, immunology etc., and all are important in the diagnosis and management of all diseases. However diagnosing, staging and grading cancer is essentially only possible through cell or anatomic pathology and this will be the focus of this chapter. Appendix 1, and boxes 1 and 2 outline the staff and infrastructure needed for cell pathology provision.

Pathology as a tool for both primary diagnosis and for subsequent management of cancer is crucial and, to date, has been severely lacking across SSA. While efficient and reliable diagnosis remains one of the most important factors in utilization of resources for all forms of patient care and public health, most importantly, in cancer, patients simply cannot be treated accurately without a pathologically-determined diagnosis. At its most basic, cell pathology, using simple hematoxylin and eosin stains, determines the answers to questions such as: is this lesion a tumour? Is the tumour benign or malignant? If malignant, what type of tumour is it and how far has it invaded? Has it been fully excised and has it metastasized to lymph nodes? Thus the clinician is provided with not just the diagnosis, but information to guide therapy, the likely prognosis and what follow-up is advisable (e.g. further surgery if an excision is inadequate). In the absence of such information, the clinician is treating the patient more or less blindly.

Even where pathology provision exists, another crucial issue compounds the problems outlined above, in many countries in SSA, namely the relative isolation of pathology and pathologists from much of the rest of the health care system, in particular the lack of regular clinical interaction. For optimum patient benefit, pathology and pathologists should be an integral part of the clinical team. The need for interdisciplinary coordination of care is especially important in cancer where complications of disease and therapy need be monitored and treated as necessary (Figure 1).

![Pathology: Referral Center Cycle of Quality Care](image-url)

**Figure 1: Referral Centre: Efficient cancer care requires both medical and surgical teams with capacity to accept referrals, provide accurate diagnoses, implement therapy and access outcomes. An interdisciplinary care team/conference is essential for appropriate integration of care, follow-up and data collection.**

Furthermore a particular challenge for pathology in SSA is that many clinical interactions are single encounters, necessitating rapid (immediate) diagnostics and treatment decisions. The most rapid turnaround time for current modern pathology technology is 24 hours, and considerably more for traditional histology. Thus a single encounter clinical interaction is in immediate conflict with the requirements of pathology assessment of cancer. This is an issue which must be addressed if cancer pathology is to develop appropriately to face the current and future cancer burden in Africa. As a result of the above, although very few accurate data are available, it is clear that many cancer patients in SSA do not receive a tissue diagnosis. One publication from the cancer registry in Makerere in Uganda has shown that at least 32% of cancer cases did not have a histology report (Parkin et al, 2001). Given the rather special nature of this Registry, it is likely that the rate is lower in many other places (see below). This inevitably leads to wrong/delayed diagnosis, unnecessarily prolonged burden of illness, failed opportunities for curative treatment and wasted use of limited resources. Furthermore, at a policy level, the development of cancer policies and of national cancer plans by Ministries of Health needs accurate registration data, based on pathology diagnoses (fig 2). These data can also be used to inform primary care providers on approaches to triage of patients, including which patients to refer to more specialized centres. In addition, tissue-based disease prevalence is
needed to develop treatment protocols and stock appropriate medications. In the absence of accurate data on the epidemiology of cancer in the country, components of national cancer plans and policies are undoubtedly misdirected.

Inadequate Planning for Cancer Care

Inadequate Referral Capability

Primary Care

Cancer Registries

Referral Center

Pathology

Inadequate Knowledge of Cancer Incidence

Inadequate Diagnosis and Treatment

Consequence of disruptions

Figure 2: MOH: Cancer care depends on a functional health system. The MOH should have both referral and feedback mechanisms in place to a) inform primary health care facilities using evidence-based disease prevalence b) provide guidelines for accessing the referral centre c) have services (anatomic and clinical pathology, radiology) to diagnose and treat patients and d) maintain cancer registries to be used for national cancer plans.

Current Status of Pathology Practice and Education in Sub-Saharan Africa

In view of all the challenges and issues outlined above, what is the current situation of pathology in SSA? Unfortunately there is a paucity of data on all aspects of pathology provision across SSA, including knowledge of manpower, infrastructure, standards, etc. In some countries, there is not even an accurate count of the number of active pathologists.

In order to determine the current status of pathology practice and training, we conducted a survey of the professional and technical workforce, of training, workload (type, volume and turn-around-time) and facilities/equipment infrastructure - note that this questionnaire addressed public sector laboratories primarily but in several countries the same pathologist works in both public and private sector. The goal was to provide a framework for each country to create a strategic plan for the advancement of pathology services to the highest level. This information will help to 1) identify opportunities to bridge services, 2) match donors with country specific needs for funding, equipment, training or mentoring and 3) encourage regional and international integration and collaboration to achieve maximal output with limited resources.

An online-survey of 65 questions was developed and made available in English, French, and Portuguese. Emails were sent to more than 300 African pathologists and collaborators in Africa, United States and Europe using lists from the four International Academy of Pathology (IAP) divisions in Africa – Francophone Africa, South Africa, Anglophone West Africa and Anglophone East Africa. Responses were received from 60 individuals and included data from 49 institutions in 30 countries. Duplicate entries for the same institution were compared and any discrepancies were resolved by sending a query to the chief of pathology at that institution. Data on 9 of the remaining 12 countries of SSA were obtained from various sources using extensive networking. Information was verified and updated in 2015 (Nelson et al, 2016; African Strategies for Advancing Pathology, 2015).

Pathologist Numbers

Overall, we have identified 724 pathologists in SSA, which is less than 1 pathologist per million population (Fig 3, Table 1). The highest rate is 4 pathologists per million in South Africa, with Botswana and Namibia having around 2 per million. Most of the other countries have gradually decreasing rates from around 1 per million down to around 0.1 per million. Just over 50% percent of this workforce is located in two countries – Nigeria and South Africa.
Table 1: Countries showing population, number of pathologists and pathology trainees

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Pathologists</th>
<th>Pathologist Trainees</th>
<th>AP or Both</th>
<th>Number of years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>11 M</td>
<td>2</td>
<td>0</td>
<td>No Data</td>
<td>4</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>10 M</td>
<td>8</td>
<td>0</td>
<td>AP</td>
<td>4</td>
</tr>
<tr>
<td>Burundi</td>
<td>10 M</td>
<td>3 (1)</td>
<td>1</td>
<td>AP</td>
<td>4</td>
</tr>
<tr>
<td>Cameroon</td>
<td>22 M</td>
<td>23</td>
<td>6 (1)</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Chad</td>
<td>11 M</td>
<td>2</td>
<td>1</td>
<td>AP</td>
<td>4</td>
</tr>
<tr>
<td>Central African Republic</td>
<td>5.5 M</td>
<td>1</td>
<td>2</td>
<td>AP</td>
<td>4</td>
</tr>
<tr>
<td>Democratic Republic of Congo</td>
<td>10 M</td>
<td>1</td>
<td>1</td>
<td>3 (1)</td>
<td>4</td>
</tr>
<tr>
<td>Cape Verde</td>
<td>2.1 M</td>
<td>1</td>
<td>2</td>
<td>No Data</td>
<td>No Data</td>
</tr>
<tr>
<td>Congo</td>
<td>11 M</td>
<td>2</td>
<td>0</td>
<td>No Data</td>
<td>No Data</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>8.5 M</td>
<td>0</td>
<td>0</td>
<td>No Data</td>
<td>No Data</td>
</tr>
<tr>
<td>Gabon</td>
<td>2 M</td>
<td>4</td>
<td>2</td>
<td>No Data</td>
<td>No Data</td>
</tr>
<tr>
<td>Gabon Republic</td>
<td>1.5 M</td>
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<td>1</td>
<td>AP</td>
<td>4</td>
</tr>
<tr>
<td>Madagascar</td>
<td>6 M</td>
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<td>1</td>
<td>AP</td>
<td>4</td>
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<tr>
<td>Malawi</td>
<td>16 M</td>
<td>9</td>
<td>1</td>
<td>AP</td>
<td>4</td>
</tr>
<tr>
<td>Mozambique</td>
<td>8.5 M</td>
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<td>1</td>
<td>AP</td>
<td>4</td>
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<tr>
<td>Namibia</td>
<td>2.2 M</td>
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<td>2</td>
<td>AP</td>
<td>4</td>
</tr>
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<td>Nigeria</td>
<td>182 M</td>
<td>150</td>
<td>211</td>
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<tr>
<td>The Gambia</td>
<td>2 M</td>
<td>0</td>
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<td>2</td>
<td>1</td>
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<td>2</td>
<td>1</td>
<td>AP</td>
<td>4</td>
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<td>1</td>
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<td>AP</td>
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<td>4</td>
</tr>
<tr>
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<tr>
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<td>242</td>
<td>78</td>
<td>AP</td>
<td>5</td>
</tr>
<tr>
<td>Swaziland</td>
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<td>0</td>
<td>No Data</td>
<td>No Data</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>13 M</td>
<td>5</td>
<td>2</td>
<td>AP</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 3: Pathologists per million, by country, in SSA
For comparison, the United Kingdom has rates of around 30 per million (personal communication, Royal College of Pathology). For SSA to achieve the same level of population cover as the United Kingdom would need around an additional 27,000 pathologists!

There are no known public sector pathologists in 6 countries: Gambia, Guineas-Bissau, Lesotho, Liberia, Sierra Leone and Swaziland. We were unable to obtain data on pathology in Somalia, Equatorial Guinea and Botswana. Namibia and Botswana have no indigenous pathologists, while pathologists from Nigeria, Uganda and DRC work in other African countries. Although we have no hard data, we are aware that in smaller institutions, some staff shortages in diagnostic work and teaching are covered by non-African pathologists who come for short or long-term assignments. In contrast a larger, un-quantified number of African and African-trained pathologists are working in the United States, Europe or Canada.

Table 2 shows the change in the population, the number of pathologists and the ratio between them for the years 1990 and 2015 for the 14 countries for which we have data. For example, Ethiopia and Rwanda have shown remarkable growth (albeit from very low numbers) while Kenya and Nigeria have also shown substantial increases. It is likely that there are several reasons for this but vigorous investment in educational programmes (see below) is at least partly responsible. Most of the other countries, while increasing overall numbers of pathologists, have, at best, simply kept pace with the increase in population, while a few have lost both in absolute numbers and in population ratio. Although we did not ask about attrition rates in the survey, personal communication from pathologists in several countries suggests that it is less than 5%/per year. However, in countries such as South Africa and Kenya with active private sector practices, 10% or more of the residents migrate full or part-time from public to private sector within the first 5 years of completing training (M. Hale personal communication).

Table 2: Changes in pathologist numbers over the past 25 years. Compares data collected in 1990 with current data.

### Table 2: Changes in pathologist numbers over the past 25 years. Compares data collected in 1990 with current data.

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>No. of Pathologists</th>
<th>Pathologists Per Million</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1990</td>
<td>2015</td>
<td>1990</td>
</tr>
<tr>
<td>Lesotho</td>
<td>1.0 M</td>
<td>25.6 M</td>
<td>0.08</td>
</tr>
<tr>
<td>Democratic Republic of Congo</td>
<td>52.9 M</td>
<td>74.6 M</td>
<td>0.28</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>62.1 M</td>
<td>45.7 M</td>
<td>1.02</td>
</tr>
<tr>
<td>Kenya</td>
<td>20.9 M</td>
<td>34.5 M</td>
<td>0.48</td>
</tr>
<tr>
<td>Malawi</td>
<td>9.6 M</td>
<td>2.2 M</td>
<td>0.40</td>
</tr>
</tbody>
</table>

Technician Numbers

All countries with pathologists have histology technicians except South Sudan. Only eighteen of 42 countries (42%) have one or more cytotechnologists. The quality of technical workforce in histology and cytology varies considerably. Some have an academic background with a laboratory science diploma or degree. Most countries have some type of certification process but the criteria are not uniform from country to country. A few institutions and private laboratories with advanced techniques for diagnosis or research such as Kenya, South Africa and Nigeria do have university-trained scientific staff but the information was not available in most responses.

Fourteen countries have technician training programs (range of 2 to 16 trainees per country, not including South Africa which trains significantly more), while others rely on on-the-job training. Only 10 countries have cytotechnology training programs. Some research grants are now beginning to incorporate technical training, especially for special stains and immunohistochemistry (IHC). External groups provide continuing education technicians on a sporadic basis.

Although the survey did not include questions on quality assurance offices or laboratory managers, informal discussions indicate that these positions are not common in the public sector except in large institutions.

Infrastructure and Service Provision

In Figure 4 we give the number of annual diagnostic procedures performed in each country - we defined diagnostic procedures as small surgical or fine needle aspiration biopsies taken to determine diagnosis prior to therapy. South Africa reported more than 100,000 biopsies and 50,000 FNAC/B per year. Kenya reported more than 50,000 biopsies and between 5-10,000 FNAC/B per year (combining both public and private sector). Nigeria reported more than 25,000 biopsies and between 5-10,000 FNAC/B per year, with Uganda, Ghana and Tanzania averaging 5-10,000 biopsies and 1-20,000 FNAC/B per year. Most of the other countries reported less than 5000 biopsies per year and less than 5000 FNAC/B per year. Only 5 countries reported processing more than 5000 cervical cytology smears per year with the majority processing less than 1000. As mentioned above, all these data are aggregated for the country. Table 3 shows the workload numbers for individual labs in Kenya.
The State of Oncology in Africa – 2015

Pathology: Total Diagnostic Procedures

Table 3: Distribution of workload between the public and private sectors in Kenya

<table>
<thead>
<tr>
<th>Name of Facility</th>
<th>Public/Private</th>
<th>Biopsies per year</th>
<th>FNACs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya National Hospital</td>
<td>Public</td>
<td>830</td>
<td>240</td>
</tr>
<tr>
<td>Aga Khan Hospital</td>
<td>Public</td>
<td>1050</td>
<td>100</td>
</tr>
<tr>
<td>Other Hospitals</td>
<td>Public and f/N</td>
<td>780</td>
<td>100</td>
</tr>
<tr>
<td>Other Hospital</td>
<td>Public</td>
<td>1500</td>
<td>100</td>
</tr>
<tr>
<td>Other Hospital</td>
<td>Private</td>
<td>2500</td>
<td>400</td>
</tr>
</tbody>
</table>

For comparison, the cell pathology laboratory at the Oxford University NHS Trust in the United Kingdom, which serves a population of around 3 million, had around 59,000 resections/biopsies, 39,000 cervical cytology samples and around 4,760 FNAC/B cases in 2015.

We asked what proportion of patients who needed a tissue diagnosis, received such a diagnosis. Of the 23 countries responding to this question, 5 (22%) estimated that at least 50% of such patients actually received one; conversely 5 other countries reported that less than 10% of patients received one. The average turn-around-time (TAT) for small biopsies was 5 days (range 1 day to 4 weeks) and for FNAC/B was 3 days. However cases sent from outlying hospitals and clinics often had much longer turn-around times due to delays in sending specimens and getting reports back which significantly diminish the impact of a correct diagnosis on clinical management.

While specific stains for infections (Ziehl Neelson for mycobacteria, Gomori Methenamine Silver for fungi) can be done in most laboratories, immunohistochimistry (IHC), which has become the primary “stain” for cancer in high income countries, is not used for routine care, except in South Africa. Thirty percent of countries surveyed do have some antibodies available but the supply is frequently linked to research projects on lymphoma or breast cancer. Six countries reported not having any special stain capability. Molecular pathology techniques, flow cytometry, and FISH which are particularly needed to provide “precision” diagnosis in cancer are not available in the public sector except in a few tertiary centres in South Africa.

Around half the countries reported providing intra-operative cytology, with twenty-five percent of countries having a cryostat for frozen sections. However, the patient volume for frozen section is low in most hospitals.

The great majority of countries reported having autopsy provision, but most did fewer than 50 medical and 50 forensic autopsies per year. By comparison over 1,200 autopsies were performed in Oxford in 2015.

Only 8 countries subscribe to quality assurance programs and over half do not have integrated laboratory information systems.

All the laboratories have at least one functioning embedding station and microtome. However, in many cases, the equipment is often inadequate, dysfunctional, and unserviceable. The lack of adequate equipment is compounded by insufficient supply of consumables such as formalin, paraffin and cassettes and other laboratory chemicals, which for most must be imported with significant delays and high import duties. Furthermore, electric and water supplies needed to operate this equipment are often unreliable so that automated equipment (present in the majority) is used in only a few countries.

Private laboratories are few in number outside of South Africa and we have no data on workload, staffing and standards except for some of the Aga Khan hospitals in East Africa.

Finally, there are virtually none of the private-public partnerships, which, in Europe and America, allow manufacturers to lease their equipment.

Education / Training

Training of pathologists for Africa historically happened outside of the continent through collaborations with the United States, Canada, the United Kingdom, Europe, and Australia (Hutt et al, 1982). These programs were either scholarship based or required funding from the foreign trainee. In either case, the programs were “traditional” in that the trainee was expected to complete a full training in anatomic pathology and either pass a local or African-based examination to be licensed to practice.
As their overall medical school and health care capacity has grown, twenty-one countries in Africa have developed training programs which can train not only their own medical school graduates but accept trainees from other countries, usually for fees. The benefit of this on continent training is that graduates more often return to their home countries (the goal), rather than staying at the site of training. The use of retention contracts as well as robust return packages for these pathologists can help in maintaining and building the workforce locally.

Several countries - Botswana, Chad, Malawi, Rwanda Tanzania, Zambia and Zimbabwe - previously sent trainees for all or partial training in neighbouring countries. Botswana, Rwanda (Mpongua et al, 2014) and Zambia have started residency training programs in the past 5 years. A major problem (which is not confined to SSA) is that less than 1% medical school graduates chose to study pathology.

These training programmes have allowed 6 countries (Ethiopia, Kenya, Malawi, Nigeria, Rwanda, and Uganda) to improve coverage. Kenya now has 1.4 pathologists per million population, but as in South Africa, a significant (see above) percentage of the workforce has migrated to the private sector full or part time.

There are only a few accrediting bodies such as the Nigerian and South African Colleges of Pathology and COPECSA (College of Pathology of East, Central and Southern Africa). External examination of residents prior to certification is often done by senior pathologists from neighbouring countries.

As a result of the above, we estimate that around 60/90 pathologists are trained each year (Table 1). However, we do not know the number leaving the public sector each year due to retirement, emigration, move to the private sector, administration or NGOs, or other reasons (although this appears to be decreasing recently). If we assume an attrition rate of around 2.5% per year, then this means that around 20 pathologists (2.1% of 724) are lost each year, resulting in a net increase of around 60/70 pathologists/year. At such a rate, it will take around 400 years to achieve United Kingdom levels of population cover (there is a “shortfall” of around 27,000; but note that this “shortfall” does not take into account the expected 50% increase of the population by 2030).

Continuing Professional Development (CPD)

In the context of very limited resources for travel, of over-burdening workload and of limited access to the literature, access to CPD is one of the most frequent requests from pathologists in SSA. A number of Continuing Professional Development programmes are provided by organisations such as the International Academy of Pathology (IAP) and its divisions and the Association of Pathologists of East, central and southern Africa (APECSA), but details are difficult to collect. For many years, but in particular in the last 10 to 20 years, a number of organisations and individuals external to SSA have provided education and training opportunities in pathology, both within and external to the continent. The majority of such initiatives are the result of concerned individuals providing short term visits, usually through personal connections and undertaken during annual leave. As such, these programmes are almost inevitably unsustainable in the long term, given their personal nature. In contrast, externally provided, inter-institutional programmes of pathology education and training are more likely to be sustainable and therefore more significant in the long term. To attempt to quantify this latter activity, we contacted 25 senior pathologists based in a broad range of charitable, academic and governmental organisations.

Although we recognize that the information probably considerably under-represents the situation, in summary, 19 external organisations were identified (although these were often highly-dependent on single individual). These included 10 professional societies and 9 universities/hospitals. Eighteen African countries were involved - 3 west, 1 central, 4 east, 7 southern and 3 north east Africa, with more than 19 different African centres in these countries. No Francophone or Lusaphone country was identified.

There were around 20 separate programmes. Fifteen of the twenty programmes were research-related, but incorporated education or CPD within them. About half the programmes were confined to one country while the others extended across several countries. Sixteen were in-country programmes (e.g. over 100 attendees at a fine needle biopsy practical) while 4 were out-of-country. Several different CPD activities and support were being provided, including courses, workshops, conferences and provision of DVDs and journals. Funding to attend international meetings was also being provided.

The Way Forward

Given the severe limitations in pathology services outlined above, it is unrealistic to expect relatively quick solutions. It will take many years to ensure reasonable coverage for the majority of the population. Undoubtedly there are numerous strategies which could and should be adopted. However, overall these strategies probably come under three main headings:

1. Advocacy
2. Collaboration
3. Innovation for improved capacity and standards

Advocacy

Advocacy is absolutely key for the future success of pathology services in SSA. The major reason for the orphan status of pathology is that it’s crucial importance in the provision of good quality health care is unrecognized, resulting in a low profile, with accordingly poor resource allocation. The case for pathology must have robust data on the value of pathology clinically - getting the right diagnosis, for the right patient, at the right time, with the right outcome. It should also include analysis of the economics of pathology, not just the costs, but importantly, the socio-economic impact of poor/absent vs. adequate pathology. For instance, a wrong diagnosis results not only in wasted resources treating the wrong condition, but the patient is often forced to pay for much more. Recently it was claimed that globally cancer costs US$2 trillion a year in direct costs and lost output (Kavall et al, 2015). If having good pathology saved only 1% of this, it would represent a saving of US$20billion, undoubtedly far less than the cost of providing the good pathology services.

Collaboration

Given the size of the challenge, it is vital that cooperation to maximise limited resources is undertaken. Accordingly, gathering interested parties and agreeing plans jointly to address the issues is another key aspect of a long-term solution.

An initial gathering of pathologists (subsequently named African Strategies for Advancing Pathology, ASAP) in June 2014 produced a preliminary 5-year plan for a way forward for pathologists (African Strategies for Advancing Pathology Group Members, 2015). It identified 4 major strategic areas: creation of an advocacy plan; creation and support of education and training networks; definition of what is needed for an acceptable operational laboratory (including definition of standards for such a lab); and leverage of private, public, research and commercial sectors and resources to address the issues.

However ASAP is only one group and there are other parties with similar interests, including the International Academy of Pathology (and affiliated groups such as the United States and Canadian Academy of Pathology, the British Division of the IAP and IAP’s African branches), the Association of Pathologists of East, Central, and Southern Africa (APECSA), the Royal College of Pathologists, the African Organization for Research and Training in Cancer (AORTIC), the American Society of Clinical Pathology, the African Society for Laboratory Medicine, Partners in Health,
In addressing the need for improvement in laboratory infrastructure, the issue is not so much the details of any specific item of equipment, but the crucial concept that all of the parts must be in place to take a piece of tissue and turn it into a diagnostic slide. One-off donations of used equipment without service contracts or accommodating hands-on training are useless across any aspect of the medicine, but especially true in pathology where each piece of equipment has different requirements (e.g., water, electricity, reagents, and tools) and can be quickly destroyed without preventative maintenance.

Beyond this, assessment of a given laboratory prior to donations can quickly identify what is missing in a laboratory to make it function well. Most often the problems are related to reagents, which are difficult to import and/or manufacture locally. However, as pathology laboratories on the continent are created and expand, the demand for these reagents should improve the flow and availability. Advocacy at the level of the Ministries of Health and Finance may help to cut delays and expedite medical supplies from significant import taxes.

Innovation in the model of pathology provision will be necessary. Currently pathology provision is largely confined to the major cities and not the rural districts where significant proportions of the population reside. Given the lack of resources this is entirely understandable. However, as travel difficulties and costs can have significant impact on a patients’ willingness to engage with the health system, where possible, cancer diagnoses and treatment options (and thus pathology services) should be provided as close as possible to home.

To achieve this, one development option may involve greater numbers of hub and spoke networks; a number of lower cost, lower level/liter labs linked to a regional or national centre. For instance, a structure of basic labs in district hospitals or clinics for specimen collection, preparation and performance of a few simple tests; linked to provincial hospital labs with greater capacity and capability, which in turn are linked to a centre with a critical mass of sustainable specialist expertise. The benefits and costs of such a model should be explored. Telepathology could be part of such a model. An education network, including regional or national CPD programmes, based on this hub/spoke model would also be key in building sustainable long-term capacity. Linking such centres to other centres of excellence (north/south, south/south) to provide access to further expertise and resources would also be vital in ensuring continuing long-term development.

Standards

Obviously most of the above proposals would not only contribute to increase in capacity but also contribute towards improved standards. However there are also approaches specific to improving standards. Examples of these are given below.

Arguably the most important would be the expansion of the current system of accreditation of labs in two ways: first in the number of labs involved and second in extending the system to involve cell pathology to a much greater extent than currently exists. To date the WHO has created the Stepwise Laboratory Improvement Process Towards Accreditation (SLIPTA) in the African Region (World Health Organization, 2015). This is a checklist process by which labs can measure and subsequently improve their quality in a stepwise fashion up to 5 level scale, the highest level being commensurate with international standards. It provides a network of laboratory inspectors and monitors to provide oversight, quality assurance, and proficiency testing. Several organizations are spearheading this including the African Society of Laboratory Medicine (ASLM). In parallel, there is a similar process for Strengthening Laboratory Management Toward Accreditation (SLMTA), aimed at the lab managers (Strengthening Laboratory Management Toward Accreditation, 2015) the two processes combining to produce sustainable high quality labs. However both are largely designed for non-cell pathology labs – microbiology, clinical chemistry etc. There is a great and urgent need to produce a similar process for cell pathology labs and this should be a priority.
There are several organisations from outside SSA which accredit cell pathology labs there, but these tend to be expensive and while they can be somewhat modified to fit local circumstances, they do not have the advantageous stepwise structure which is a feature of SLIPTA.

A perhaps unexpected area of potential benefit to standards is in the development of robust IT systems. These latter have considerable ability to improve rapid communication with clinicians and patients and with other pathologists using, for instance, smart phones and tablets, thereby reducing turnaround times significantly. IT-based specimen tracking through the lab can reduce handling errors and help manage more rapid processing of cases. Furthermore, IT-based structured reporting in cell pathology (synoptic reports using datasets) can ensure that a report cannot leave the lab until all the relevant information needed for best clinical care is detailed (Ellis et al, 2016). It should also be noted that there are an increasing number of digital image analysis systems which aim to make a diagnosis based on assessment of digital images of a true section (He et al, 2012). If these systems achieve the abilities predicted for them, then the need for trained morphologists will become more manageable.

Creation of all of the above (especially any organizational change) will take time but additional support is needed now. Fortunately components such as opportunities for periods of training abroad, funding fellowships to attend international meetings and exchange programmes with centres abroad currently exist and efforts to increase these in the short term would be beneficial.

We also recognize that the above can be seen as a counsel of perfection, but it provides a framework within which improvements can be made. Furthermore as different countries are currently at different levels of development, not all of the possible solutions listed above will apply everywhere. Indeed each country and region will presumably choose to adopt those components which best suit their needs, but the key objectives for all will be to increase both capability and capacity to an appropriate level.

Conclusion

Fifty years ago, there were few African pathologists working in SSA. Pathology practice was limited to a few centres with ex-patriot specialists or samples were sent to Europe and the United States. Since that time many of the independent African nations have expanded the number of medical schools and developed medical specialty training. From that very basic starting point, pathology has improved a little. However, although we are fully aware that the data presented in this chapter are incomplete and perhaps inaccurate in many ways, it is clear that there is still a massive deficit in pathology provision in the great majority of countries. In a few countries, there are some labs with a full range of services, but in most countries much of the population has almost no access to good quality, timely and appropriate services.

Addressing the issues will be a long-term project and we have suggested a variety of ways in which the problems can be tackled. However the region is a diverse collection of countries operating at a huge range of functional levels and there is no single solution that will work for all. Despite this, if use of internal and external resources is properly strategized, much progress can be made relatively quickly.

Appendix

What does it take to provide pathology services?

To have a functioning anatomic pathology lab providing histology services, a series of adequately stocked and well maintained stations are required which include the following: specimen receiving/logging, grossing, formalin to paraffin processing, embedding, microtomy, staining, deparaffinization, sectioning, and cover slipping. To provide special stains, an additional series of stations after microstomy are required based on the special stains desired. To provide immunohistochemistry, an additional set of reagents (antibodies and secondary antibodies) are required based on the immunoprofile being offered. Each station requires adequate clean fresh water and electricity, which must be uninterrupted for some pieces of equipment. A computerized laboratory management system can be overlearn which tracks samples, predicts resource needs, and creates efficiency and quality control. All of these stations can be run by a qualified histotechnologist; however, for effective throughput, 2 to 3 histotechnologists per lab are required. Histotechnologists require a technical degree with one year or more of apprenticeship in a specialized histology training program. One pathologist, reading the slides produced by such a lab, can manage perhaps 5000 surgical specimens alone, assuming they have full mastery of all specialties (i.e., a true general expert). But anatomic pathology is a complex specialty where many different types of cancer—often subtle and with different treatments and prognoses—occur in the same organ. Thus, having two or more pathologists per laboratory allows for diversification of specialty. At a minimum, all pathologists should have a network of other pathologists on whom they can rely to share and diagnose difficult cases. Major referral centres in a given country must consider the need for a full cadre of professionals.

Components of a Maximally Resource Pathology Department

Professional Staff

- Certified Anatomic and Clinical Pathologists with sub-specialty expertise
- Surgical Pathology, Autopsy Pathology/Forensic Sciences, Cytopathology, Hematology/Coeagulation, Blood Banking, Clinical Chemistry, Microbiology, Molecular Biology
- PhD/MS Level Researchers
- Clinical Chemistry, (Molecular Biology), Systems Analysts, Epidemiologists, Immunohistochemists
- Certified Lead Technologists
- Histotechnology, Cytotechnology, Mortuary Science

Academic Teaching and Training Program

- Medical student curriculum in anatomic and clinical pathology
- Linked to other disciplines, case-based learning
- MMed Pathology
- Linked to clinical research programs
- PhD Pathology/Clinical Laboratory Sciences
- Sandwich programs/clinical research programs
- Special Courses/Continuing Medical Education
- Histotechnology training
- 1 year certification
- Short courses in advanced techniques (Special Stains, IHC)
- Cytochemistry training (would require several years)
- Certification and continuing education
- Molecular Pathology
- MMed or PhD programs
- Mortuary Sciences
- Autopsy assistants (local and regional) and research assistants (study based specimen collection)

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Africa: Pathology in the Sub-Sahara

Mortuary Sciences

- Autopsy assistants (local and regional) and research assistants (study based specimen collection)

Histotechnology, Cytotechnology, Mortuary Science

1. Histotechnology
2. Cytotechnology
3. Mortuary Science

Special Courses/Continuing Medical Education

- Special Courses/Continuing Medical Education
- Histotechnology training
- 1 year certification
- Short courses in advanced techniques (Special Stains, IHC)
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PhD/MS Level Researchers

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Medical student curriculum in anatomic and clinical pathology

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- MMed or PhD programs
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Chapter 3 – Africa: Pathology in the Sub-Sahara


References


Chapter 4

Africa: Surgical Oncology Platforms

Population-Level Scale-Up of Surgical Oncology Platforms in Africa, with a Particular Focus on Women’s Cancer Care


Expanding Surgical Care for Cancer

Africa is facing an unprecedented rise in annual cancer incidence burden of nearly 70% by 2030, relative to 2010 (Bray et al, 2012). The vast majority of these malignancies will be tumours of the solid type, most of which require surgery as a key management approach across the spectrum of presentations. Women’s cancers, including breast, cervical, vulvar, endometrial, and ovarian cancers, represent a substantial fraction of rising cancer rates (Bray et al, 2012). Advanced and high-intensity surgical approaches remain cornerstones of treatment of advanced stage women’s cancers, and such interventions are often restricted to facilities with highly specialized workforces and well-resourced infrastructures. On the other hand, interventions for cancer prevention and control rely on the performance of relatively lower-intensity surgical procedures on healthy or minimally symptomatic individuals. Examples of such include loop electrosurgical excision procedure (LEEP) for precancerous cervical lesions, total hysterectomy for atypical endometrial hyperplasia or endometrial intraepithelial neoplasia, breast lumpectomy for ductal carcinoma in situ (DCIS), prophylactic mastectomy and salpingo-oophorectomy in cases of women with BRCA1/2 gene mutations. Quite often, if not always, such interventions are performed in contexts of, and linked to, active screening programs, since a vast majority of these conditions are only discovered through early detection efforts such as population-based screening programs or risk-based screening for well-identified familial/genetically-linked conditions.

The demand for public health cancer surgery platforms is expected to grow as the global focus on cancer prevention increases and the discovery and implementation of more accurate methods of screening results in detection of earlier stage disease. This is particularly true in low-income countries where the need for such services is rapidly increasing and efforts to develop and bring them to scale have been few (Uribe-Leitz et al, 2015). Training cadres of surgeons who can treat advanced stage disease is essential to cancer care. However, they must also be equipped...
to perform the equally critical and increasing surgical interventions that prevent cancer (preventive surgery), and to become activist leaders in cancer control. This will require creative disruption of the traditional curative-focused, technologically-heavy, biomedical model of cancer surgery training. A more expanded vision will need to approach malignancies as complex disease entities that have unique social, economic, and cultural determinants, and are partially manifestations of unjust, inequitable, and dysfunctional health care systems (Confortini and Kong, 2015).

Mapping Resources to Garner Political Support and Tailor Interventions to The Local Context

A prerequisite to scaling up cancer surgery service platforms is an assessment of the specific country’s cancer burden and state of cancer care. Interviews with appropriate government officials, healthcare providers and members of civil society, including patients and their families, community workers, traditional healers, tribal chiefs, etc. are critical to identifying gaps and local and national priorities. Uncovering the factors that (i) delay the decisions of patients to seek care, (ii) delay their arrival at health facilities, and (iii) delay the provision of adequate care, will provide the basis for targeting scarce resources (Thadeus and Maine, 1994). The quantity, quality and functionality of equipment and supplies, availability of running water and electricity, access to safe blood transfusion services, chemotherapy and radiation, the presence of postoperative facilities, numbers, types and qualifications of health care personnel, are examples of the questions that should be included in the assessment (Komen Giants). The desired end result is a data-driven map of problems, gaps and needs specific to each country/region, which in turn constitutes the pathway for developing, planning, implementing, evaluating, and further modifying the surgical intervention. The accumulated information can also be used to advocate for resources and generate the political will that is needed for program expansion and sustainability.

Integrating Surgical Care for Cancer Within Existing Health Care Systems

Cancer surgery service platforms across Africa must be tailored to address the specific needs of the particular country, integrated into existing public health infrastructures, and be part of a larger effort to strengthen the public health sector’s overall response to non-communicable diseases. However, the challenges of setting up disease control initiatives in low-resource settings are compounded by the fact that funding and interest are often aligned vertically, i.e., with a narrow and singular focus on a disease or aspect of a disease. On the other hand, most health related problems are multifactorial and require a broad response.

Integrating vertical initiatives within existing broad-based primary health systems, and thereby achieving horizontal synergies across several diseases and domains is critical to achieving long term success and sustainability. An example is the use of previous investments in HIV-related related diagnostic, laboratory and blood transfusion services as platforms for cancer care. The diverse subsystems of the cancer care continuum, from prevention to palliation, including access to services, procurement and distribution of medical equipment and supplies, accountability, user fees and indirect payments, must be tightly integrated across the health care system. Weaknesses in any one has cross-cutting effects on the other aspects of service delivery, leading to short term success at best. Anticipating how any new interventions will follow through, interact with, and impinge on each subsystem is thus crucial (Sturman, 2000; World Health Organisation, Mutale et al, 2013).

Essential Components of a Scale-up Effort

Building upon the few examples of surgical care scale-up in low-resource African settings, a few clear themes to inform a conceptual framework emerge (Figure 1).

Scaling-Up Women's Surgical and Gynaecologic Oncology Services

Start by Doing What's Best, Easiest and Most Impactful

Focusing on cancers that have the greatest burden in the population, and in which surgery has been shown to have significant impact, is a critical initial priority. Simultaneously implementing contextually-appropriate screening and early detection programs for such priority cancers, alongside the scale-up of cancer surgery service platforms, and tightly linking positive screening results to diagnostic and treatment interventions, is a necessity. Examples of such interventions in the women’s cancers domain include “screen and treat” using VIA (visual inspection of the cervix using acetic acid and cryotherapy/cold coagulation/loop electrosurgical excision procedure for cervical cancer prevention; clinical breast examination and ultrasound-guided biopsy of palpable breast masses for breast cancer early detection. Initially choosing only a few sites (and

Figure 1: Conceptual Framework for Scaling Up Women’s Surgical and Gynaecologic Oncology Services in Low- and Middle-Income Countries
aiming for those with the best infrastructure, adequate levels of human resources and highest burden of disease) for testing the scale-up model would facilitate success.

Select a Surgical Intervention Model that is Safe, Achievable, Resource-Appropriate and Sustainable in the Environment

It is critical to use resource-stratified guidelines and cost-effectiveness as the basis for treatment algorithms (e.g., Breast Health Guidelines International (BHGI) for breast cancer (Anderson et al, 2011) and National Comprehensive Cancer Network (NCCN) for cervical cancer (Koh et al, 2013)). Centralizing complex surgical procedures that are highly resource and infrastructure-dependent to a central training centre, and initially scaling up only the less complex surgical procedures to district hospitals will lead to a sustainable and cost-efficient approach to expansion (Figure 2). Neoadjuvant chemotherapy could facilitate operability of advanced cases of cervical and breast cancer at the district hospital level as it has the potential to reduce tumour volume and intraoperative blood loss (Mans et al, 2014; Maun et al, 2005; Kehoe et al, 2015).

Women’s Oncology-Related Procedures and Diagnostics

<table>
<thead>
<tr>
<th>Breast</th>
<th>Gynecologic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple mastectomy with sentinel lymph node biopsy</td>
<td>Simple mastectomy with sentinel lymph node biopsy</td>
</tr>
<tr>
<td>Ultrasound-guided lumpectomy</td>
<td>Simple vulvectomy; wide local excision of the vulva</td>
</tr>
<tr>
<td>Thoracentesis</td>
<td>Bowel resection</td>
</tr>
<tr>
<td>Abdominal paracentesis</td>
<td>Resection of ovarian mass/omentum</td>
</tr>
<tr>
<td>Super/f_icial inguinal lymphadenectomy</td>
<td>Simple hysterectomy, bilateral salpingooopherectomy</td>
</tr>
<tr>
<td>Loop electrosurgical excision procedure</td>
<td>Biopsy of the vulva, vagina, cervix and endometrium</td>
</tr>
</tbody>
</table>

The State of Oncology in Africa - 2015

A critical component of the global response to the HIV/AIDS epidemic has been delivery of care by multidisciplinary teams (Rabkin and El-Sadr, 2015). Borrowing from this successful model, local mid/senior-level general surgeons and gynaecologists would undergo intense, competency-based training designed to produce women’s cancer surgical specialists, capable of performing surgical procedures for the priority-cancers in their environment, e.g., radical abdominal hysterectomy and pelvic lymphadenectomy for cervical cancer; lumpectomy and modified radical mastectomy with axillary node dissection for breast cancer. Training would take place at a central training centre under the tutelage of surgical and gynaecologic oncology faculty. Classic bedside and intraoperative teaching could be enhanced with computer-based learning, telementoring, low-cost simulations, and post-mortem, anatomy-based training to optimize the training experience and reduce training time (Austry et al, 2013). For remaining members of the multidisciplinary team training would be aimed at enhancing their capacity to support the delivery of surgical cancer care in district hospital settings, under the leadership of the newly trained cadres of surgeons. Core multidisciplinary team members could include obstetrician/gynaecologists, general surgeons, anaesthetists, pathologists, radiologists, licentiates/clinical-officers, nurses, social workers, program managers, operations managers (with a specific focus on the supply chain), community educators/patient navigators. Ancillary team members could include operating-room technicians, psychosocial counsellors, pharmacists, pharmacy technicians, monitoring and evaluation specialists, radiographers and pathology technicians. Following their training, the women’s cancer surgical specialists and their multidisciplinary teams could be dispersed to district hospitals where they will deliver surgical cancer care in a ‘hub and spoke’ relationship with a central training centre. At all levels of care the importance of strong clinical leadership, professionalism and transparency, as well as an intolerance of corruption and disrespectful attitudes, must be emphasized.

Find Innovative Approaches to the Severe Shortage of Healthcare Workers

One approach to expanding women’s cancer surgical care in the face of limited numbers of cancer surgical specialists is task-shifting selected responsibilities to generalists and physicians under close guidance and monitoring. Women’s cancer surgical specialists at district hospitals would be directly supported by cadres of less specialized physicians (e.g., family physicians or ‘general medical officers’) or physician assistants (e.g., clinical officers, licentiates) to whom well-defined clinical tasks can be redistibuted, according to specific regional/national regulations and local contextual necessities (Austry et al, 2013; Chu, Ford and Threlfall, 2011; Federspiel et al, 2015). Although nurses are typically not licensed to undertake surgical procedures in these settings, context specific adaptations may allow them to provide front-line surgical care for relatively low-risk surgery (e.g., biopsy of lower female genital tract lesions including loop electrosurgical excision of the cervix, biopsy of the vulva, endometrial biopsy, ultrasound-guided biopsy of palpable breast masses) after adequate training and under constant supervision. Attention should be paid to health worker satisfaction, career development, and competitive remuneration.

Harness and Incorporate Affordable Technology into the Women’s Cancer Surgery Platform

The adoption of point-of-care tests that generate real-time diagnoses without the need for sophisticated laboratory platforms can greatly enhance surgical care accessibility without the need for repeat visits (a factor seen as critical for unhampered access). The use of tele-pathology for both training/mentoring as well accessing expert opinion (Parham et al, 2010), and the use of low-cost mobile-health technologies for supporting patient follow-up and community-wide education, can be vital adjuncts to the success of any surgical cancer care system. Finally, the use of key tumour markers for risk stratification and treatment decision-making (e.g., oestrogen and progesterone receptor and human epidermal growth factor receptor markers for breast cancer (Toss and Cristofanilli, 2015); CA-125 for ovarian cancer) and novel gene expression prognostic tests (e.g., Oncotype DX, Pam50 for breast cancer) to predict response to treatment are vital.
Set Up a Rigorous Process to Collect Data, Monitor and Evaluate Interim Outcomes: Metrics, and Make Adaptations for Program Expansion

There is a paucity of data relative to the role of surgery in the treatment of cancer in LMICs, thus establishment of surgical cancer care databases (or an electronic medical record system) should be an integral component of any cancer care program. Several models for peer-review and integrated quality improvement systems exist and need adaptations to the low-resource context. Use of standardized checklists for surgical procedures (Haynes et al, 2009), morbidity and mortality conferences, clinical audits and the use of multidisciplinary conferences to discuss case management have all been used in high income countries to improve internal procedural quality.

Collateral Benefits of Women’s Surgical Cancer Care Training

The skills acquired during women’s surgical cancer care training can be leveraged to improve the care of women with gynaecological, complex non-malignant gynaecologic problems (e.g., severe endometriosis, tubo-ovarian abscesses, pelvic floor prolapse etc.) and difficult Caesarian sections, the latter a component of Safe Motherhood.

The scale-up of surgical care systems for women’s cancers in low-income countries should be aligned with the overall objectives of the WHO Global Action Plan for the Prevention and Control of Noncommunicable Diseases (WHO, 2013). Implementing and scaling up surgical care services in a public health framework will help ensure they are integrated in a manner that strengthens health systems at all levels - improvement of basic infrastructure (running water, electricity, waste disposal, electronic communication), maintenance (sterilization of equipment, house-keeping), procurement and distribution of supplies (equipment and drugs, shared instruments for all surgery cases), laboratory and diagnostics (hematologic and blood chemistry, basic imaging techniques, pathology services), blood transfusion, etc. Unlike the current model focused on high-tech, expensive and protected approaches used to train surgical subspecialists in high-income countries, training in LMICs should be resource-contextualized and aimed at the efficient production of cadres of women’s cancer surgical specialists who will serve as leaders capable of and safely performing specific surgical oncology procedures using intensive, competency-based curricula. While international partnerships should be formed to help ensure the realization of these goals, local leaders must provide conceptual guidance to ensure contextual relevance of training activities is maintained. Multidisciplinary support teams should be trained to function efficiently as a cohesive unit. Types of surgical procedures and diagnostic services offered at tertiary and district hospitals should be resource-stratified and aimed at the efficient production of cadres of women’s cancer surgical specialists who will serve as leaders capable of and safely performing specific surgical oncology procedures using intensive, competency-based curricula. While international partnerships should be formed to help ensure the realization of these goals, local leaders must provide conceptual guidance to ensure contextual relevance of training activities is maintained. Multidisciplinary support teams should be trained to function efficiently as a cohesive unit. Types of surgical procedures and diagnostic services offered at tertiary and district hospitals should be resource-stratified. Rigorous monitoring and evaluation of services are mandatory, and their expansion should be facilitated using affordable technology and closely monitored task-shifting, where possible.

Collateral Benefits of Women’s Surgical Cancer Care Training

The skills acquired during women’s surgical cancer care training can be leveraged to improve the care of women with gynaecological, complex non-malignant gynaecologic problems (e.g., severe endometriosis, tubo-ovarian abscesses, pelvic floor prolapse etc.) and difficult Caesarian sections, the latter a component of Safe Motherhood.

Through Investment in Public Sector Infrastructure, Education and Training.

Surgical cancers have a major impact on economic output at a national level and scaling up these systems is both cost effective and affordable. The demand for cancer-related surgery is growing. By 2030 there will be an estimated to be 21.6 million cancer patients every year, of whom around 17.3 million will need surgery. 10 million of those patients needing surgery in 2030 will live in LMIC and of these about 6 million will be living in Africa. Across Africa three-quarters of the surgical burden will be from cancers of the breast, head and neck, esophagus, stomach, lung, cervix, stomach and prostate. Over the global surgical community in 2030 will need to deliver an estimated 45 million procedures for cancer (Africa will need some 18 million of these), and even low income countries will experience a 59% increase in need. Surgery, of which there are nearly 100 different procedures needed for cancer care, is essential for prevention, diagnosis, palliation, reconstruction and cure across all age groups; 20% of children with cancer will need a surgical procedure. Surgery has one of the biggest impacts on patient outcomes, with over 50% of survival in breast cancer, for example, attributable to surgery alone. However, estimates from Global Surgery 2030 suggest that today over three-quarters of patients globally do not receive safe, affordable or timely surgery for their cancer.

Countries Are Projected To Lose 0.5 To 1.5% Of Gdp, Annually, Between Now and 2030 If Surgical Systems for Cancer are not Strengthened.

Without urgent and strategic investment in surgical services for cancer care, global economic losses from cancers-acceptable to surgical treatment are estimated to total US$12.12 billion by 2030. This equates to losses of 1.5-1.6% of GDP (in HIC and 0.5-1.5 % of GDP in LMIC, annually. With 34 countries Africa stands to be one of the biggest losers without scale up. In countries where there is no universal financial risk protection against the costs of cancer surgery, a diagnosis of a surgical cancer can be financially devastating for individual patients and their families. In LMIC about a third of patients experience financial catastrophe and another quarter discontinue treatment because they cannot afford the cost. Scaling up surgical cancer services and ensuring patients are protected from catastrophic health expenditure related to accessing cancer surgery represents a sound health investment with broader implications for poverty alleviation, economic productivity and development. In Africa we estimate one year after diagnosis with cancer nearly three quarters of patients have died or experienced catastrophic expenditures, particularly on surgery. Surgical cancers have a major impact on economic output at a national level and scaling up these systems is both cost-effective and affordable.

Conclusions and Policy-Impact

The Lancet Oncology Commission into Global Cancer Surgery (Sullivan et al, 2015) and Global Surgery 2030 (Meera et al, 2015) provides the respective frameworks for building affordable, equitable, safe and sustainable cancer surgical systems across Africa. The key messages remain:

Over 80% of the 15.2 Million People Diagnosed with Cancer Worldwide in 2015 Will Need a Surgical Procedure at Some Pointin their Treatment.

The demand for cancer-related surgery is growing. By 2030 there will be an estimated to be 21.6 million cancer patients every year, of whom around 17.3 million will need surgery. 10 million of those patients needing surgery in 2030 will live in LMIC and of these about 6 million will be living in Africa. Across Africa three-quarters of the surgical burden will be from cancers of the breast, head and neck, esophagus, stomach, lung, cervix, stomach and prostate. Over the global surgical community in 2030 will need to deliver an estimated 45 million procedures for cancer (Africa will need some 18 million of these), and even low income countries will experience a 59% increase in need. Surgery, of which there are nearly 100 different procedures needed for cancer care, is essential for prevention, diagnosis, palliation, reconstruction and cure across all age groups; 20% of children with cancer will need a surgical procedure. Surgery has one of the biggest impacts on patient outcomes, with over 50% of survival in breast cancer, for example, attributable to surgery alone. However, estimates from Global Surgery 2030 suggest that today over three-quarters of patients globally do not receive safe, affordable or timely surgery for their cancer.

National Cancer Control Plans Must Include the Strengthening of Surgical Systems Through Investment in Public Sector Infrastructure, Education and Training.

Country studies have found a many universals around barriers to accessing safe, affordable and timely surgery for cancer. There are also many novel solutions being undertaken from which the global cancer surgery community can learn. Effective cancer surgery can only be delivered if the patient presents early enough, which requires addressing socio-cultural barriers, as well as key interdependencies in cancer surgery - imaging and pathology (both of which need very significant improvement). In the context of inequities among and within countries in terms of access to surgery services there is a serious shortage of cancer surgeons in over 82% of countries, are this is a universal feature across all African countries. There is an critical need to up-skill general surgeons to deliver basic cancer surgery and to create more surgical oncology training programmes through high quality, accredited training across a range of site-specific cancers. This is best achieved with country-specific initiatives and by...
Less than 5% of Global Cancer Research is Devoted to Surgery Despite its Huge Impact on Patient Outcomes and its Importance to Personalized Cancer Medicine.

There is an urgent need to increase research funding for cancer surgery. Despite its central role in improving patient outcomes, only 1.3% of public cancer research funding goes towards cancer surgery research (in Africa this is less than 0.2%). LMIC only account for around 15% of global research in cancer surgery yet these countries urgently need to conduct their own context specific cancer research. Investment in cancer surgical research has significant value for health systems as innovations not only have significant impact on patient outcomes, but they also leverage multiple other areas of cancer research critical for driving research into personalized cancer medicine.

Global Cancer Surgery Needs to be a Political Priority for Policymakers in Countries, Research Funders, International Organisations and Global Alliances.

Policymakers at all levels have low awareness of the central importance of surgery in cancer control. The political and social culture of cancer surgery is shaped by organisational, symbolic, economic, scientific, and politicians’ perspectives that need to be better understood by the cancer surgical community. Cancer surgery needs to better articulate its impact and lead changes necessary for delivering safe, affordable and timely surgery to all. Lastly, cancer surgery must be represented at all levels of cancer control planning and advocacy, and those institutions delivering research, training and education should be the target of ODA and philanthropic funding from major organisations (Dare et al., 2015).

Pathology Surgery Imaging

Down-staging with neo-adjuvant radio-chemotherapy

Table 1: Economic losses to Africa due to lack of surgical capacity

<table>
<thead>
<tr>
<th>GBD Region</th>
<th>% loss of potential GDP in 2030</th>
<th>GDP loss in 2030</th>
<th>Cumulative GDP Loss (2015-2030)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Africa and Middle East</td>
<td>0.367%</td>
<td>37,967,965,223</td>
<td>3.60028E+11</td>
</tr>
<tr>
<td>Eastern sub-Saharan Africa</td>
<td>0.699%</td>
<td>5,733,885,587</td>
<td>48691489419</td>
</tr>
<tr>
<td>Western sub-Saharan Africa</td>
<td>0.531%</td>
<td>3,529,036,620</td>
<td>31609787040</td>
</tr>
<tr>
<td>Central sub-Saharan Africa</td>
<td>0.574%</td>
<td>6,887,676,026</td>
<td>6459240952</td>
</tr>
<tr>
<td>South Asia</td>
<td>0.571%</td>
<td>62,005,928,581</td>
<td>6.40842E+11</td>
</tr>
<tr>
<td>Southern sub-Saharan Africa</td>
<td>0.574%</td>
<td>4,005,025,644</td>
<td>44093861522</td>
</tr>
<tr>
<td>Central Latin America</td>
<td>0.571%</td>
<td>32,730,099,701</td>
<td>3.09369E+11</td>
</tr>
<tr>
<td>Central Asia</td>
<td>0.573%</td>
<td>3,238,576,472</td>
<td>31557258656</td>
</tr>
<tr>
<td>Andean Latin America</td>
<td>0.701%</td>
<td>7,151,553,008</td>
<td>65999355867</td>
</tr>
<tr>
<td>Tropical Latin America</td>
<td>0.738%</td>
<td>23,985,817,879</td>
<td>2.42002E+11</td>
</tr>
<tr>
<td>Western Europe</td>
<td>0.751%</td>
<td>1.36293E+11</td>
<td>1.51654E+12</td>
</tr>
<tr>
<td>Caribbean</td>
<td>0.760%</td>
<td>1,263,504,726</td>
<td>12225499457</td>
</tr>
<tr>
<td>Southeast Asia</td>
<td>0.788%</td>
<td>43,841,468,590</td>
<td>3.9527E+11</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>0.941%</td>
<td>36,222,364,701</td>
<td>4.04651E+11</td>
</tr>
<tr>
<td>High-income North America</td>
<td>0.960%</td>
<td>2.27384E+11</td>
<td>2.38167E+12</td>
</tr>
<tr>
<td>Central Europe</td>
<td>1.006%</td>
<td>23,051,641,333</td>
<td>2.65831E+11</td>
</tr>
<tr>
<td>Australasia</td>
<td>1.049%</td>
<td>15,513,996,731</td>
<td>1.6275E+11</td>
</tr>
<tr>
<td>Southern Latin America</td>
<td>1.092%</td>
<td>18,104,450,126</td>
<td>1.83757E+11</td>
</tr>
<tr>
<td>Oceania</td>
<td>1.112%</td>
<td>63,196,5591.3</td>
<td>5861874801</td>
</tr>
<tr>
<td>East Asia</td>
<td>1.284%</td>
<td>4.21458E+11</td>
<td>3.45078E+12</td>
</tr>
<tr>
<td>High-income Asia Pacific</td>
<td>1.500%</td>
<td>1.4181E+11</td>
<td>1.56037E+12</td>
</tr>
</tbody>
</table>

Table 2: Surgical rate and volume for countries with observed surgical data from African countries with data available, compared to other LMIC and high income countries

<table>
<thead>
<tr>
<th>Country (year of reported surgical data)</th>
<th>Population in 2012</th>
<th>Total health expenditure per capita adjusted to 2012 US$</th>
<th>Annual number of operations</th>
<th>Total surgical rate per 100,000 population*</th>
<th>Total cancer surgical rate per 100,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan (2015)</td>
<td>31,624,145</td>
<td>275</td>
<td>623,183</td>
<td>619</td>
<td>3.4</td>
</tr>
<tr>
<td>Australia (2012)</td>
<td>22,721,900</td>
<td>4.34</td>
<td>2,673,094</td>
<td>10,161</td>
<td></td>
</tr>
<tr>
<td>Brazil (2012)</td>
<td>1,862,511</td>
<td>4.40</td>
<td>5,760,083</td>
<td>33,294</td>
<td></td>
</tr>
<tr>
<td>Canada (2012)</td>
<td>31,737,227</td>
<td>83</td>
<td>5,759</td>
<td>3,494</td>
<td></td>
</tr>
<tr>
<td>United States (2012)</td>
<td>31,499,164</td>
<td>20</td>
<td>2,673,094</td>
<td>162</td>
<td></td>
</tr>
</tbody>
</table>
### Africa's Surgical Oncology Platforms

<table>
<thead>
<tr>
<th>Country (year of reported surgical data)</th>
<th>Population in 2012</th>
<th>Total health expenditure per capita adjusted to 2012 US$</th>
<th>Total number of operations</th>
<th>Total surgical rate per 100,000 population</th>
<th>Total cancer surgical rate per 100,000 population</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghana (2012)*</td>
<td>22,637,454</td>
<td>317,633</td>
<td>333</td>
<td>1,461**</td>
<td>**</td>
<td>79</td>
</tr>
<tr>
<td>Kenya (2012)*</td>
<td>32,249,197</td>
<td>1,316,407</td>
<td>1,236**</td>
<td>4,433**</td>
<td>**</td>
<td>79</td>
</tr>
<tr>
<td>Nigeria (2011)*</td>
<td>184,362,920</td>
<td>5,818,037</td>
<td>5,791</td>
<td>23,570**</td>
<td>**</td>
<td>79</td>
</tr>
<tr>
<td>South Africa (2012)*</td>
<td>54,940,409</td>
<td>12,133,411</td>
<td>12,165**</td>
<td>52,155**</td>
<td>**</td>
<td>79</td>
</tr>
<tr>
<td>Tunisia # (2011)</td>
<td>11,410,547</td>
<td>15,568</td>
<td>15,380**</td>
<td>65,233**</td>
<td>**</td>
<td>79</td>
</tr>
<tr>
<td>Egypt (2010)**</td>
<td>82,660,000</td>
<td>5,087,725</td>
<td>5,115**</td>
<td>20,328**</td>
<td>**</td>
<td>79</td>
</tr>
<tr>
<td>Morocco (2012)*</td>
<td>34,025,300</td>
<td>1,304,730</td>
<td>1,287**</td>
<td>5,628**</td>
<td>**</td>
<td>79</td>
</tr>
<tr>
<td>Afghanistan (2011)*</td>
<td>25,050,000</td>
<td>305,250</td>
<td>301**</td>
<td>1,204**</td>
<td>**</td>
<td>79</td>
</tr>
<tr>
<td>Bangladesh (2012)*</td>
<td>157,000,000</td>
<td>741,500</td>
<td>733**</td>
<td>29,572**</td>
<td>**</td>
<td>79</td>
</tr>
</tbody>
</table>
| * Surgical rate is calculated using the total population for the year the surgical data was available.

# Regional rates extrapolated to entire country.

## References


Radiotherapy is one of the main treatment modalities for cancer. This form of treatment has been used for treatment of cancer for more than 100 years (Bernier et al, 2004; Thariat et al, 2013). Shortly after the discovery of x-rays, both low-energy x-rays and radium sources were used for treatment of superficial tumours (Bernier et al, 2004). Regression of tumours was often noted, but so were radiation side effects or toxic effects. With growing experience and knowledge of the effects of radiation on normal tissues and tumours which led to the use of fractionation, careful dose calculation, and better targeting, radiotherapy has secured its place as indispensable for cancer treatment and control (Thariat et al, 2013). The invention of high energy radiotherapy, delivered by 60 Co machines and linear accelerators, the use of computers, simulators, Computer Tomography and other new imaging techniques and better clinical care have led to improved outcomes and significantly fewer side-effects.

It is well known that the benefits of radiotherapy can be optimized if it is deployed to appropriate patients, in early-stage disease, and when indicated in combination with other treatment modalities. Patients must first be identified and then assessed by multidisciplinary teams to determine the best management plan. This process starts with accurate diagnosis made after physical examination, investigation and biopsy followed by histopathological assessment. This might include immunohistochemistry and molecular and cytogenetic testing, followed by disease staging, before establishing the overall treatment plan. Pathology and medical imaging are the mainstays of cancer diagnosis while surgery, radiotherapy, chemotherapy are the mainstay of cancer treatment. The three treatment modalities that is surgery, radiotherapy and chemotherapy are not interchangeable, but complementary.

The role of radiotherapy within the National Cancer Control Plan is well defined in the management of cancers. It is integral to the management of most cancers, including breast, lung, prostate, head and neck, and cervical cancers, which together account for more than two-fifths of cases worldwide. Radiotherapy can provide excellent local tumour control, which is not always achievable with surgery, and preserves normal form and function. For example, radiotherapy for laryngeal cancer allows larynx and hence voice conservation, an important factor contributing to quality of life and ability to return to work after treatment.
Incorporation of radiotherapy into multimodal management of breast cancer or limb sarcomas makes mastectomy or amputation unnecessary. Radiotherapy can be used alone as in early-stage prostate cancer, in which most patients are cured or in combination with surgery and chemotherapy, as in breast cancer and lung cancer. Radiotherapy can be used preoperatively to shrink tumours in order to improve their resectability, or postoperatively to eradicate residual microscopic cancer deposits in tissues surrounding the resected area. Radiotherapy is also frequently used in combination with chemotherapy.

Neoadjuvant chemotherapy is given before radiotherapy to reduce tumour volume and improve the effectiveness of radiotherapy where indicated. Concurrent chemotherapy is given in a wide range of indications to enhance the effect of radiotherapy. Adjuvant chemotherapy is used to eradicate occult distant cancer spread where radiotherapy is expected to achieve control of the local tumour mass.

Nowadays, in an era of personalized medicine, technological advances in radiotherapy make it possible for beams to be shaped and modulated to conform to the exact shape of tumours, maximizing radiation dose deposition in the cancer while sparing normal tissues from unacceptable high doses i.e. those most likely to evoke normal tissue toxic effects (Bortfeld, 2006; Jaffray et al, 2007). Radiotherapy is also a powerful instrument in palliation of symptoms associated with cancer. Modern approaches to cancer treatment frequently rely on all treatment modalities—surgery, radiotherapy, and chemotherapy, to achieve the best results with least damage. With improvement in control of metastatic disease, local tumour control is more important than ever.

In African countries, although cancer is rapidly becoming a public health crisis, the use of radiotherapy to treat patients with cancer is still limited due to lack of equipment, low cancer awareness, health-care infrastructures which are stretched to the limits due to competing priorities, high cost of cancer care, and the scarcity of radiation oncologists, medical oncologists, pathologists, surgical oncologists, and other health-care workers who are needed for cancer care. The few trained radiation oncologists and technicians who work in Africa are overwhelmed and cannot cope with the increasing demands from cancer patients.

At the moment out of the 52 African countries, only 23 offer radiotherapy (Datta et al, 2014a). South Africa and Egypt, however, account for roughly 60% of all radiation therapy resources in the continent. Ethiopia, which at the time of writing this report has one radiotherapy machine, has been estimated to need 74-85 machines to meet patient requirements (Datta et al, 2014a; Moraes et al, 2015). External beam radiotherapy is the most widely used form of radiation treatment in sub-Saharan Africa, with brachytherapy rarely used. The two types of radiotherapy machines used are cobalt-60 and linear accelerators. Cobalt-60 machines are simpler, easier to use and relatively inexpensive to acquire and maintain compared with linear accelerators, but they are not capable of complex treatment plans and have a fixed energy level and a lower percentage depth of dose. Linear accelerators can do complex and precise treatment plans with lower skin doses than cobalt-60 machines, but are relatively expensive and difficult to maintain, which may result in treatment delays. This perception is however changing rapidly as appropriately priced linear accelerators are becoming available. These Linacs can be small enough to place in old 60Co bunkers as replacement for such technology and yet be functionally of a high standard.
Brachytherapy machines can be used to treat patients with cancers such as cervical cancer. Radiotherapy is indicated for many cancers in Africa, including breast and cervical cancers (Smigelska et al, 2012). Investigators of one study conducted in Brazil estimated that 83% of patients with breast cancer should receive radiotherapy, but only 10.8% actually received it (Moraes et al, 2015). Availability of radiotherapy compliments surgical options for cancers such as breast and rectal cancers and can improve outcomes of resection.

Because of poor availability of radiotherapy services in many countries in Africa, alternative approaches have been investigated. Intra operative breast radiotherapy, for example, can address the inadequate infrastructure and poor patient compliance associated with long treatment proto cols. In a study in South Africa (Shulman et al, 2014; Bonas et al, 2015a), women with early breast cancers were treated with 21 Gy intraoperative radiotherapy. After 7 years of follow-up, only one patient (2.6%) had local recurrence, four (10.3%) had regional recurrences, and three (7.7%) had systemic relapses. The cost was $1300 per patient, compared with $9000 for standard external beam radiotherapy. More short-course options such as this need to be developed to optimise the use of the few resources available to most patients and health-care systems in the region.

Consideration of the complications of radiotherapy is important in discussion of its use in African countries. In a report from Nigeria in which records from patients treated with radiotherapy from 2000 to 2003 were examined, 105 patients (31.7%) received a higher dose than planned and 65 patients (19.4%) received a lower dose than planned. In the report, 16 deaths (4.8%) were believed to be potentially related to the treat ment. However, there are reports that this situation is improving with support from the International Atomic Energy Agency, whose approach includes support for training and infrastructure and peer review by quality assurance teams (Samei, 2013).

A recent addition in brachytherapy is electronic brachytherapy (EBT) which administers of high dose radiotherapy (HDR) brachytherapy without the use of radioactive isotope and with minimal shielding requirements due to the low energies utilized with the system. This means that the machine can be used in controlled settings without a specially shielded vault as required for isotopes based brachytherapy machines, such as in the office of an authorized user or in an operating room. EBT uses a disposable miniature low energy (50keV) X-ray tube into a pre-positioned applic ator within body/tumour cavities or skin surfaces to rapidly deliver high doses of radiotherapy. Through the manipulation of radiation intensity and dose distribution, EBT delivers more intense therapy directly to cancer sites with minimal radiation exposure to surrounding healthy tissue. Another potential advantage includes a shorter treatment schedule. Electronic brachytherapy can be used to treat breast cancer, non-melanoma skin cancer, gynaecological and other cancers.

In this chapter we describe the role of radiotherapy within the National Cancer Control Programme in relation to medical and surgical oncology, the state of radiotherapy resources in Africa, socio-cultural aspects and Radiotherapy, the role of Government, Civic Society and Donors and argue that radiotherapy must be included in public health efforts to improve cancer care in the Africa.

Introduction

The main treatment modalities for cancer are surgery, radiotherapy and chemotherapy. In developed countries such as Australia it is estimated that about half of cancer patients would benefit from radiotherapy for treatment of localized disease, local control of advanced disease, and palliation (Barton et al, 2014). In Africa this figure can be as high as 75% and above due to advanced stage disease at presentation, yet this crucial form of cancer treatment has been largely absent from the health agenda in African countries. It has over the years also continued to receive very little funding. As a result, there is an unacceptable shortfall of radiotherapy services, with more than 90% of the population in African countries lacking access to radiotherapy (Sahbazet al, 2013). Furthermore, the growing burden of cancer places increased demand on the already very limited radiotherapy services in Africa.
In this chapter, since investment in radiotherapy in Africa is crucial, unavoidable and an imperative, an economic case for investment in radiotherapy will be presented. This will hopefully dispel the misleading perception that deployment of radiotherapy services in Africa is not feasible.

The Role of Radiotherapy in the Management of Cancer

Currently, radiotherapy ranks with surgery as the two most important methods of curing localised cancer. Radical radiotherapy can affect cures in head and neck cancers, cancer of the cervix, prostate and early Hodgkin Disease, and also in a number of unresectable brain tumours of young people. Radiotherapy can be administered operatively when surgery is undertaken to preserve function, after surgery where clear excision margins cannot be achieved (adjuvant) and after debulking surgery where gross residual tumour is left behind. Radiotherapy can either facilitate surgery or consolidate surgical gains, as well as reducing local recurrence in cancers such as anal and rectal carcinomas, breast tumours, and where breast-conserving surgery has been employed for breast cancer.

Brachytherapy is still in use in life-threatening situations, such as profuse bleeding from a tumour, or the superior vena cava syndrome. Radiotherapy also provides effective palliation in cases of pain secondary to bone metastasis, tumours causing bleeding or compressive syndromes, such as spinal cord compression or cerebral metastatic disease. In these circumstances radiotherapy is given as an emergency treatment. A single dose fraction, or a small number of fractions, will often have an appreciable palliative effect and remove the need for protracted therapy schedules.

Where radiotherapy is indicated, the patient may be treated using two broad groups of equipment: teletherapy - treatment from a distance; or brachytherapy - treatment with radioactive sources placed temporarily within body cavities or tissues. For both techniques, quality assurance is important in order to have motivated staff and prevent skills flight.

Radiotherapy Service Provision in Africa – Gaps and Inequities

Radiotherapy centres should ideally be made available as part of radiotherapy service provision, especially in Africa where patients travel far and spend a lot of time away from home to get these services.

Multidisciplinary cancer management is essential for good treatment decision-making and treatment outcomes. Centres for radiotherapy treatment should therefore be ideally planned with that in mind. In all eventualities, a tumour board or multi-disciplinary clinic should define which types of patients should be referred for radiotherapy and what treatments should be instituted. For those patients living a distance from the radiotherapy centre, funding would have to be set aside for the costs of transport. Accommodation facilities within easy reach of these facilities should ideally be made available as part of radiotherapy service provision, especially in Africa where patients travel far and spend a lot of time away from home to get these services.

The staffing needs of radiotherapy services should also be reviewed as an important part of service delivery. Where possible, training should be undertaken locally to ensure that students are trained with patients and equipment relevant to the needs of the country. Staff welfare that is holistically addressed is important in order to have motivated staff and prevent skills flight.

Radiotherapy Service Provision in Africa – Gaps and Inequities

Infrastructure

Africa is a large and diverse continent with many and diverse infrastructural needs varying from country to country. There is no one size fits all recommendation due to the variations in cancer epidemiology, cultures, socioeconomic structures and allocation/availability of resources for cancer management in the various countries. Overall African countries are burdened by different communicable diseases, nutritional concerns and vector control strategies that have hogged the limelight and reduced the realization of cancer as one of the major priorities. The situation of radiotherapy infrastructure in the continent says it all.
Generally there are no set plans for development of infrastructure, be it setting up of new radiotherapy centres, expansion to achieve adequate facilities for population size nor maintenance and replacement of existing equipment. As a result most radiotherapy infrastructure currently in use is old or poorly maintained with comparatively long machine downtime to what is considered as the norm. Access to these centres is limited by the shear inadequacy of treatment facilities, long distances that patients have to travel, long waiting lists and in some instances the cost of treatment.

It is however worth noting that there is some development in radiotherapy treatment facilities in Africa with most new well-equipped centres being set up in countries that are relatively better resourced. These are mainly in North Africa and South Africa. In countries like Tanzania, Zimbabwe and Ethiopia new radiotherapy machines have been installed or are being installed. Some centres in sub-Saharan Africa have undertaken extensive refurbishment exercises to a high standard and a few new centres have been set up there as well. There is still however a serious shortage of radiotherapy resources, both human and infrastructural. Recently the only radiotherapy machine in Uganda broke down causing untold suffering to cancer patients. On the whole radiotherapy is still not well addressed in national cancer control plans and is little understood at policy-making levels.

**External Beam Equipment (Teletherapy Equipment)**

Table 1 shows the status of radiotherapy treatment equipment in Africa at the end of 2015. This was obtained from self-reported information by 22 of the countries with radiotherapy facilities in the public sector. Of these 6 were from North Africa and 15 from sub-Saharan Africa with South Africa being the 22nd of these countries shown separately on this table. It is noteworthy that most of this external beam equipment is situated in North African countries and South Africa. Whilst these two sub regions are still relatively under-equipped somewhat, it is in sub-Saharan Africa that radiotherapy facilities still fall far short of expectation.
Africa with an estimated population of 1.2 billion has only 394 teletherapy units of which 376 are megavoltage units. The best outlook would be to consider this to represent 3 million patients per treatment unit. With the knowledge of the unevenness in the distribution of equipment amongst the countries that have and more than half of the African countries going without radiotherapy facilities at all, the gravity of the situation is very apparent.

Only 16% of this vital equipment is found in sub-Saharan Africa of which over half is either orthovoltage or 60 cobalt technology. Only 2 out of 15 countries with radiotherapy facilities in this sub region do not use 60 cobalt teletherapy units at all.

North Africa has however seen a surge of growth in radiotherapy treatment capacity and technology. More than half of the teletherapy equipment is found in this sub-region’s 6 countries that have radiotherapy facilities. Less than a quarter of this is orthovoltage and 60 cobalt technology. Similarly South Africa has a high number of teletherapy units with the least proportion of 60 cobalt and orthovoltage units (12%) in Africa.

Utilization of this teletherapy equipment can be partly assessed by simple measures of availability of treatment planning facilities and imaging. As shown on table 2, there are a few countries in sub-Saharan Africa offering radiotherapy treatment that still do not have radiotherapy treatment planning systems and with also a few having 2 dimensional treatment planning capability only thus limited to even do forward planning. Most countries have 3 dimensional treatment planning systems but only 7 countries in the whole of Africa reported to utilize inverse planning modules of which all are in North Africa and South Africa. This shows the relative lack of IMRT usage in sub-Saharan Africa in the public sector. With current trends leading to more and more application of IMRT in radiotherapy and its benefits in sparing normal tissues whilst giving adequate dose to the tumour this situation needs to be addressed. Most published work on radiotherapy in the literature is based on the usage of IMRT as standard.

African radiation oncologists face a possibility of not being able to generate corresponding home-grown evidence-based strategies due to this technological lag.

### Table 1: External beam treatment equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Sub-Saharan Africa (SSA)</th>
<th>South Africa (Total)</th>
<th>SSA Countries Without (n=6)</th>
<th>South Africa (n=1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear Accelerator (LINAC)</td>
<td>28</td>
<td>0</td>
<td>184</td>
<td>0</td>
</tr>
<tr>
<td>CT</td>
<td>6</td>
<td>11</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>11</td>
<td>190</td>
<td>12</td>
</tr>
</tbody>
</table>

SSA = Sub-Saharan Countries (n=15, South Africa excluded) NA = North African Countries (n=6)

### Table 2: External beam treatment planning equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>SSA Countries Without (n=6)</th>
<th>South Africa (n=1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT Simulator</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Dedicated CT</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>CT Simulation</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>No TPS</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Only 2D TPS</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>3D TPS</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Inverse Planning Module</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>SPECT / PET / CT scanner</td>
<td>18</td>
<td>10</td>
</tr>
</tbody>
</table>

SSA = Sub-Saharan Countries (n=15, South Africa excluded) NA = North African Countries (n=6)

### Nuclear Medicine

The specialty of Nuclear Medicine is very closely linked to the management of cancer. In Africa a large number of nuclear medicine departments operate in radiotherapy centres of which they are part. Nuclear medicine molecular imaging employing the fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) has revolutionized the management of cancer in routine clinical service and is now a key procedure in oncological imaging. PET/CT has had a significant impact on diagnosis, treatment planning, staging, therapy, and monitoring of treatment response and has therefore played an important role in the care of cancer patients, being useful in a large number of common cancers. For cancers which do not have tracer uptake mechanisms suitable for FDG imaging, more specific tracers are used and these are in constant development.

PET/CT imaging can avoid overtreatment where lesions seen on other imaging modalities may be of doubtful significance. PET/CT may make it possible to cure cancer where it was otherwise impossible to do and to detect and effectively treat recurrent disease in a more meaningful way. There is also increasing use of therapeutic radiopharmaceuticals to treat various cancers.

All the reported PET/CT facilities in Africa are located in North and South Africa with the rest of the facilities having SPECT technology as shown on table 2. The need to expand nuclear medicine facilities in support of cancer management and upgrade to newer technologies is therefore very clearly demonstrated.

### Brachytherapy

Brachytherapy using remote after loading of a single HDR source was developed in the 1970s. The use of high dose rate brachytherapy (HDR) is advocated for centres with a large number of patients to treat due to shorter treatment times. Another advantage of HDR brachytherapy is the ability to change dwell times (i.e. the time a source remains in one position) of the stepping source, which allows dose distributions that closely match the target volume. Brachytherapy is a major treatment modality in the treatment of common cancers and in Africa it is mainly used to treat cervical cancer as intracavitary treatment, a tumour of very high prevalence in the region.
Table 3 shows that 18/22 countries in Africa have adopted the HDR technology. Medium dose rate (MDR) and low dose rate (LDR) equipment is still very much in use. The increased demand for high dose rate (HDR) brachytherapy equipment has resulted mainly from the discontinuation of the limited production of low dose rate equipment. Whilst the concept of remote after loading was first introduced by Siervet in 1937 to eliminate radiation exposure to personnel, to date, a number of countries, mostly in sub-Saharan Africa are still practicing manual after loading techniques. So far electronic brachytherapy is not available in Africa.

Table 3: Available Brachytherapy Equipment Resources

<table>
<thead>
<tr>
<th>Brachytherapy</th>
<th>SSA Countries With</th>
<th>SSA Without</th>
<th>NA Countries With</th>
<th>NA Without</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDR after load</td>
<td>13</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>HDR after load</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>HDR after load</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Manual Brachytherapy</td>
<td>4</td>
<td>12</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Permanent Implants</td>
<td>2</td>
<td>14</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

SSA = Sub-Saharan Countries (n=16 - South Africa included) NA = North African Countries (n=6)

Transition from 2-D to 3-D brachytherapy is still therefore not an option for most countries as the prerequisites such as access to 3-D volumetric patient imaging modalities including computed tomography and magnetic resonance are still limited. Furthermore potential benefit of implementing 3-D HDR brachytherapy needs to be balanced with the higher cost and more time consuming nature of the imaging and the 3-D treatment planning process particularly in departments that have a high throughput of patients. There is however an improvement in treatment outcome with 3-D HDR that can outweigh the disadvantages stated.

The use of permanent implants is currently not widespread in the continent and where available these are mainly used to treat early prostate cancer.

Human Resources

Quality radiotherapy delivery requires a team of dedicated, well trained staff in the fields of radiation oncology, medical physics, and radiation therapy technology and oncology nurses. The sophisticated equipment requires regular maintenance to eliminate unacceptable down time. In house frontline service engineers have been advocated for in Africa where maintenance services are mostly poor. Flight of skills is a common occurrence in the continent with all of its consequences. This leads to a chronic inadequate capacity of well trained staff overall but more so in the field of radiotherapy.

Table 4 shows the level of staffing in the various sub-regions of Africa. Although sub-Saharan Africa is the most affected, the continent as a whole however, falls way short of the ratios expected of staff to patient/population ratios in radiotherapy. Medical physicists have further, the issue of lack of recognition as a stand-alone profession in some countries still. This fuels flight of skills in this field where local training programs are also scarce. Oncology nursing is not yet an established nursing subspecialty in most countries and 6/22 of countries reported as having no trained oncology nurses at all.

Table 4: Human Resources in Radiotherapy

<table>
<thead>
<tr>
<th></th>
<th>Sub-Saharan Africa n=15</th>
<th>North Africa n=6</th>
<th>South Africa</th>
<th>Total n=22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel staffing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiation Oncologists</td>
<td>141</td>
<td>141</td>
<td>111</td>
<td>495</td>
</tr>
<tr>
<td>Medical Physicists</td>
<td>67</td>
<td>181</td>
<td>115</td>
<td>383</td>
</tr>
<tr>
<td>RT Technologists</td>
<td>227</td>
<td>67</td>
<td>140</td>
<td>434</td>
</tr>
<tr>
<td>Radiation Laboratory Technicians/ Medical Technicians</td>
<td>15</td>
<td>8</td>
<td>12</td>
<td>35</td>
</tr>
<tr>
<td>Radiation treatment staff</td>
<td>10</td>
<td>5</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Radiation therapy planning</td>
<td>107</td>
<td>110</td>
<td></td>
<td>217</td>
</tr>
<tr>
<td>Radiation therapy planning</td>
<td>107</td>
<td>110</td>
<td></td>
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<tr>
<td>Radiation therapy planning</td>
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<td>Radiation therapy planning</td>
<td>107</td>
<td>110</td>
<td></td>
<td>217</td>
</tr>
</tbody>
</table>

CPD = Continuous professional development, RTT=Radiation Therapy Technologist

Development of local training programs is known to be an effective way of ensuring reasonable staff retention generally. This must not however, be achieved by lowering standards of training if quality radiotherapy services are to be achieved. Most countries reported having academic educational or clinical training programs that will hopefully go a long way in alleviating human resource disparities in the region. This scenario was different a decade ago when most countries relied on external training of professionals. The practice of compulsory continuous professional development mirrors these training programs in that where there are no training programs, continuous professional development is not given priority.

Socio Cultural Considerations in Radiotherapy Practice in Africa

It is well known that cancers in Africa are largely diagnosed late, treatment is often not accessed nor given, there are high rates of default and poor follow up. There are many reasons for this although many socio cultural factors may come into play and in some instances be the major players. The effect of these factors may be more wide ranging than the resultant negatives mentioned. There is also a wide variation from sub region to sub region in this vast continent. It is important that the practitioner fully understands and puts measures in place to minimize negative social impact and capitalize on the strengths of positive perceptions within the local communities served in order to develop an effective radiotherapy service.
In most parts of Africa, illness is associated with pain. It can therefore be easily concluded that a painless lump, as is typical of how early cancer presents, is not associated with illness. As such, health-seeking behaviours are modified and patients tend to decline interventions for early cancers thus tipping the balance towards presentation with late stage disease.

Presenting with late stage disease can also be as a result of alternative beliefs in causation of disease such as witchcraft, whereby other forms of remedy are sought prior to visiting the hospital as a last resort. The effect is more pronounced on vulnerable groups such as minors, albinos, women and poorer members of society (See figure 4). The menace of large, unsightly malignant lesions as commonly seen in Africa needs to be addressed through extensive awareness and educational campaigns that are appropriate for the sociocultural norm of the communities that are targeted.

Radiotherapy is sometimes also misunderstood to be a treatment that is hot and that burns. This perception, apart from its derivation from linguistics, can be attributed to the common use of old equipment technology that has little or no skin sparing effect thus causing severe skin reactions. With patients coming from long distances to get treated and usually having hypofractionated treatments to increase throughput, the full manifestations of skin reactions may occur when the patients have been discharged and are back in the remote areas where knowledgeable responses may therefore be a case for investing in modern equipment.

The assessment of treatment outcomes is very important for each individual treatment unit and collectively as it can give an indication of the quality of service provided. There are also other good reasons of promoting good follow-up strategies that are beneficial to the patients’ wellbeing. Follow up of patients in Africa is generally known to be poor not just for post radiotherapy patients alone but is more marked with cancer patients. This has been ascribed to lack of transportation for the usually long journeys back to the tertiary treatment institutions. It is also linked to general poverty and inadequate communication networks. Great attention needs to be given to this, as in such circumstances outcomes of interventions cannot be evaluated for self-assessment, documentation and future planning. With increased uptake of mobile phones and the internet in Africa, these can be vehicles that can be explored to facilitate better follow up in patients treated for cancer and other diseases.

Radiotherapy as a Component of National Cancer Control Plan

It is well known that to fight cancer effectively, a cancer control approach is essential. This involves specific and coordinated activities focused around prevention, early detection, diagnosis, treatment and palliative care. Improving access, affordability and delivery of all these services to cancer patients requires a multidisciplinary set of expertise that can only be made available by the government and different organisations engaged in the global fight against cancer.

It is important for African countries to understand that radiotherapy is a critical and inseparable component of comprehensive cancer treatment and care because in many of the most common cancers in African countries, radiotherapy is essential for effective treatment. Although in these countries, radiotherapy is indicated in more than half of all cases of cancer to cure localized disease, palliate symptoms, and control disease in incurable cancers, in planning and building treatment capacity for cancer, radiotherapy is frequently the last resource to be considered. Consequently, access to radiotherapy is unacceptably low in Africa. This needs to change if cancer care is to improve in Africa.

Since several studies have provided compelling evidence that investment in radiotherapy not only enables treatment of large numbers of cancer cases to save lives, and bring positive economic benefits; African countries are advised to conduct accurate assessment of the available healthcare resources and demand for radiotherapy, so as to address the shortfall in radiotherapy services. The shortfall in radiotherapy refers to the difference between currently available radiotherapy resources and what would be needed to optimally deliver necessary radiotherapy services to patients with cancer.

In view of the variable patterns of cancer presentation and limited information on the current proportion of patients receiving radiotherapy, estimation of the exact proportion of new cancer cases that will need radiotherapy is challenging. During the past 20 years, several investigators (Borras et al, 2015a,b; Samiei, 2013; Barton et al, 2014; Delaney et al, 2005) have developed evidence-based estimates of desirable radiotherapy use on the basis of the indications for radiotherapy in clinical practice guidelines and the distribution of cancers and different stages of disease at presentation.

These estimates suggest that 50–60% of all patients with cancer will need radiotherapy. Optimum allocation of radiotherapy resources within the framework of a national cancer control plan necessitates monitoring of both the national cancer burden and the population’s cancer staging, as well as determination of radiotherapy use by cancer type. Only then can resource requirements be estimated to align radiotherapy-intervention need to cancer burden effectively over time.
Although epidemiological data for worldwide incidence and distribution of cancer are available, the data are not enough because the relations between cancer burden and radiotherapy resources (services, equipment, and personnel) needed to address this burden also depends on factors such as access, levels of use, cancer stage distribution, and the nature of the required radiation treatment. In view of the factors mentioned above, the following three approaches are recommended for estimating radiotherapy requirements to meet current and future needs.

**Approach 1: Estimation of the Radiotherapy Services Based on the Burden of Cancer in the Country**

The first approach is to find out the number of patients with cancer in need of radiotherapy and the radiation treatment resources needed based on the number of individual radiotherapy treatment visits or fractions that should be made available to the population in need of care. There are two approaches that have been used to estimate appropriate radiotherapy use. Criterion-based benchmarking (Mackillop et al, 2015) is an empirical approach, which measures the use of radiotherapy services in population groups privileged enough to have optimum access to services, delivered under optimum conditions. The rate of use in these privileged communities is used as the benchmark for optimum rate of use (Kerba et al, 2007).

The second approach is an epidemiological, evidence-based estimation approach, in which the appropriate level of radiotherapy use is estimated for radiotherapy services by using decision models underpinned by evidence-based guidelines, cancer type, and disease stage, to allocate patients to radiotherapy or no treatment (Barton et al, 2014; Delaney et al, 2005). Comparison of the two methods shows that the latter approach typically predicts higher rates of use than criterion-based benchmarking, raising questions about which approach is more reliable (Mackillop et al, 2015; Aoki et al, 2014). A challenge with the criterion-based benchmarking approach is that privileged communities are not easy to define in African countries because of the lack of reliable data.

**Approach 2: Estimation of Radiotherapy Services Based on the Burden of Cancer in the Country**

The second approach is to translate the number of radiotherapy fractions or courses needed into resources needed to provide the radiotherapy fractions. Several rules of thumb define the number of patients or courses that can be served by one megavoltage machine or per radiotherapy professional (Slotman et al, 2005; IAEA, 2010).

A benchmark of 400–500 patients per radiotherapy treatment unit per year has been suggested for suitable machine throughput, whereas annual numbers of 200–300 patients per radiation oncologist, 300–500 per medical physicist, and 100–150 per radiation technologist have been suggested (IAEA, 2010; IAEA, 2008). There are fewer recommendations, however, for the resources needed to deliver several fractions. Although various studies (Datta et al, 2014b; Rosenblatt et al, 2013) have been done to forecast the number of radiotherapy units and personnel needed on the basis of these figures, other factors affecting resource needs should be considered when estimating required resources. The proportion of long-course versus short-course treatments will affect the number of fractions needed, which, in combination with the level of complexity of radiotherapy used, will affect the resources needed (Dunscombe et al, 2014).

Thus, when determining investment in radiotherapy, there are many benefits associated with characterizing the demand and the work to be done in terms of delivered fractions rather than courses. To overcome the shortcomings of the guidelines used to estimate resource needs, an activity-based costing model can be used (Leves et al, 2003). To populate the activity-based costing model, assumptions in relation to facility size and level of complexity, equipment chosen, construction costs, personnel costs, and details of the operating model (i.e., working hours and time needed by staff to do various activities are made. The value of these variables is affected by economic standards, work regulations, and the costs associated with the distance that patients have to travel to treatment facilities.

**Approach 3: Estimation of Radiotherapy Services Based on International Recommendations**

The International Atomic Energy Agency recommends as reasonable levels of radiotherapy services for developing countries one teletherapy machine per 1,000,000 population and for developed countries one teletherapy machine per 250,000 population. The third approach is easy to use but it does not take into account the variables within and among populations.

**Investments Needed to Establish Radiotherapy Services in Africa**

Africa has an acute shortage of health workers in general and lack of qualified staff in radiotherapy specifically. The lack of qualified staff in sufficient numbers is the main obstacle to the development of radiotherapy in Africa. A survey done by IAEA/AFRA in 2012/13 to assess the existence, number and location of education programmes for the five main radiotherapy professions revealed that most African countries had no training programmes (Ndlovu et al, 2013). It is therefore important that investments in radiotherapy education are made to get the required human resources.

**Regulatory Body Investment**

Radiotherapy can cause substantial harm if it is not delivered safely. Because of this, the International Atomic Energy Agency, International Commission on Radiation Units and Measurements, and National Council on Radiation Protection and Measurements (a United States national association) have been given the mandate to set safety and quality standards for the use of ionizing radiations. However, enforcement of safety and quality standards is the responsibility of national governments, which should incur the cost to establish national regulatory bodies with sufficient authority and independence to undertake assessments and inspections, enforce minimum standards, provide authorization, and issue licenses.

Regulation of occupational, medical, and public exposure to ionizing radiation requires adherence to dose constraints, guideline-based therapy, and a commitment to maintaining exposures as low as reasonably achievable. Trained personnel in medical physicists and physicians with medical specialization in radiation oncology must oversee this system and participate in organized quality-assurance review (Jeffay et al, 2015).
Technical Investments

The practice of modern radiotherapy requires huge investments in technology that vary substantially with the technological package that is purchased. Treatment machines and simulators typically need a reliable power supply and some degree of environmental control, including specific air-handling requirements. Treatment units that require high energy demands, such as Co units, address these issues but can present other challenges, including transporting and replacing the radioactive source amid increased international security and transportation concerns.

Societal Investments

Since radiotherapy is delivered as a daily treatment modality, patients have to find accommodation near the treatment facility or travel back and forth from home each day. Adequate roads, transportation, and financial support for the cost of receiving treatment from home must be available to encourage adherence to treatment. Furthermore, access to nursing and hospital services to manage radiotherapy side effects during and after treatment is essential.

Civil Society’s Investments

The role of national civil societies in engaging in awareness building, policy development, mobilizing support, expanding access, implementation, and education is undeniably. Global civil societies ensure that cancer is framed as an integral part of the global commitments to address NCDs and thereby engage a wider range of supporters for expanding access to worldwide improve radiotherapy to address outcomes for cancer. The involvement of patients with cancer is essential in the development of civil society’s voice and capability. Patients are well positioned to advocate for access to high-quality services and care.

Professional Associations’ Investments

Professional associations such as Africa Radiation Oncology Group (AFROG) and Africa Organization for Research and Training in Cancer (AORTIC) have an important role in expanding access to radiotherapy through education, training, setting quality standards, disseminating knowledge and evidence, and planning of human and other resource needs. There is an urgent need for the professional associations in Africa to work together more effectively to accelerate the progress in expanding access to radiotherapy.

References

Chapter 6 – Africa: Radiotherapy Technology

Africa: Radiotherapy Technology for Low and Middle Income Countries

Peter A.S. Johnstone, Gregory P. Johnstone, Indra J. Das

Radiotherapy Technology for Low and Middle Income Countries

Per the World Bank, countries are divided in three categories based on gross national income (GNI). Eighty-two countries (38% of the established global regulated bodies) operate with a GNI below $4,125 per capita (Nielsen, 2011). The burden inherent in such a discrepancy compared to other countries is dramatic; the highest income economies being more than three times the individual rate as the middle cohort and continue to increase rapidly. No continent suffers the global wealth distribution burden more than Africa. With Africa as the centre not simply of the vast global landscape but its economic disparity, Africa includes 51% of the world’s low- and middle-income countries (LMIC). Since 76% of African nations are LMIC, requiring a national focus for them on healthcare resourcing and cancer prioritisation may be short-sighted. Strategically, the demands of infrastructure are too tremendous to consider cancer care above basic health reform or development. In the presence of Ebola, basic health needs in education, vaccination, infectious disease control weigh heavily in the minds of leadership. Health infrastructure as currently operationalised is hugely subsidised via beneficiary bodies. Under these circumstances, sadly there is little room for a specialised cancer treatment like radiotherapy, with its host of requirements for a full integrated and operationalised treatment for curative intent or minimal beneficial treatment.

The basic needs for LMIC are to give food, shelter and basic health care. Unfortunately the financial burdens of many countries are so large that they cannot even afford even minimum basic health care. Cancer is treated as an incurable disease and treatment is beyond the reach for most patients due to unavailability, distance, or cost.

There is a silver lining for the United States because of its huge spending on cancer care. The American Cancer Society recently reported the death rate from cancer is falling since 1990 based on the surveillance data in men and women and in every disease site (ACS, 2015). This trend is tribute to the vast amount of resources used in developed countries to combat non-communicable diseases. In general, the per capita death rate in these countries also is falling linearly in other diseases such as heart disease and stroke (Ma et al, 2015).
The disparity between Radiotherapy access in high-income and LMIC has been noted by IAEA and WHO for over 2 decades through manpower and resource allocations (Levin et al, 1999; Levin et al, 2002; Tatsuzaki et al, 2001). Since Radiotherapy is capital intensive, in LMIC countries inevitably it ranks low in the list of priorities (Atun et al, 2015). However, the global disparity is so large that now most communities are trying to address this issue (Barton et al, 2006a; Barton et al, 2006b; Levin et al, 2002; Tatsuzaki et al, 2001). Several journals have devoted special issues related to global cancer health where serious concerns about the African continent are clearly explored (Atun et al, 2015; Datta et al, 2014, 2015; Jaffray et al, 2015a; Jaffray et al, 2015b).

Lost in most of the current Radiotherapy literature is the fact that recent exciting advances in precision and personalized therapies are remarkably limited in geographic scope. To be sure, the developed world boasts remarkable technologies that encompass genomic fingerprints informing Radiotherapy (Torres-Roca, 2012) and proton and carbon ion therapy (Oax et al, 2015). Overlooked is the fact that 39 of the worlds 214 countries have no Radiotherapy facilities whatsoever (Zubizarreta et al, 2015). Radiotherapy is a critical component of the cancer care continuum in high-income countries where at least 40% of the patients get radiation sometime in their care during cancer management. From a global cancer control perspective, for an entire nation to have no Radiotherapy access is simply unacceptable. Upon close examination however, there may be many reasons for this to be the case.

**Infrastructure Issues**

The World Bank data reveals 139 of the world’s economies are LMIC (Nielsen, 2011). This equates to about 82% of the world’s population: about 5 billion persons in middle-income and 850 million in low-income economies. The challenges to these nations gaining Radiotherapy access are several, including: economic, utility, healthcare, repair, and unique infrastructures. Each will be discussed in some detail below.

**Economic**

By “economic,” we mean to include not simply a stable national currency, but the existence of some sort of state-sponsored health coverage which is vital to the population. In the absence of this, new health technology usually comes on a cash basis via private entrepreneurs. Such assets are not universally available to the population and are distributed unevenly to leadership or richer cadres. The inclusion of state supported coverage implies that high-capital items such as advanced imaging and Radiotherapy might be available on some program for all members of a population, usually accompanied by state support for its acquisition.

In many LMIC countries, widely available healthcare is available only through an uncoordinated patchwork of clinics and hospitals managed by religious and non-governmental organizations (NGO). An example is the Moe Teaching and Referral Hospital in Eldoret, Kenya, supported by AMPATH (Academic Model for the Prevention and Treatment of HIV/AIDS) (Asirwa et al, 2015). Under these circumstances, finances may be available for a cobalt machine or linear accelerator, but given the infrastructure challenges below they may not be used for that purpose.

**Utilities**

The most critical aspect of using any piece of high technology is stable power supply. In LMIC this is often no existent. Even in highly sophisticated infrastructure countries such as the United States, during heavy load periods in winter and summer, even national electrical grids fail to provide power to critical structures.

We have previously published that, at the Indiana University Cyclotron, one of the major contributors to downtime were power failures (Miller et al, 2012). Importantly, this not only included frank loss of power, but more problematic “brown outs”, where a rapid loss and resumption of power causes circuit breakers to trip to prevent damage to sophisticated technology. During a power outage, equipment will not work because of lack of power. After a brown out—even with rapid resumption of stable power—equipment may not work because of damage to the circuitry.

**Healthcare**

Realistically, while cancer care is an important part of any national health plan, it is far from the most critical. Prenatal care, infant inoculations, distributed vaccinations and infectious disease control all serve as far more basic national responsibilities. Cancer control however should be a focus of a mature national healthcare priority.

Within cancer, Radiotherapy should be an early focus because of its extensive palliative properties. As any country begins to come to grip with cancer within its borders, the vast majority of patients will not be curative but palliative. Radiotherapy has an excellent capacity to palliate the pain and mass effect of primary and metastatic sites, and the cosmetic/toilet issues of skin lesions. While the transition to a national cancer focus on prevention and cure comes far in the future, even in the United States about 2/3 of all cancer patients will receive Radiotherapy during their life (https://www.astro.org/News-and-Media/Media-Resources/FAQs/Fast-Facts-About-Radiation-Therapy/Index.aspx).

Even so, Radiotherapy relies heavily on at least two other sophisticated medical practices that must simultaneously exist in the healthcare milieu. For instance, the ability to obtain and interpret tissue sample is important not simply to provide a cancer diagnosis, but also to determine the histologic type. Radiotherapy fractionation schemes for lymphoma are vastly different than for squamous cell cancers. Physicians and technicians with facility in cytologic interpretation are as important to a radiotherapy practice as are radiation therapists. Similarly, proper Radiotherapy targeting requires adequate three dimensional imaging in most cases. CT is suitable in the vast majority of cases, but even CT is unavailable in many LMIC.

**Repair**

In high-income countries, managing a clinic of linear accelerators (linacs) is relatively uncomplicated. Most sites have more than one unit, so if a linac breaks down for whatever reason, patients can be moved to another unit, and treatment can be completed. With the exception of catastrophic failure, maintenance agreements available within hospitals or purchased from vendors guarantee rapid repair in most locations. Preventive maintenance (PM) is well defined and based on decades of experience on thousands of identical units. Because of these favourable circumstances, uptime of linac-based oncology departments varies between 92%-98% (Bjarningard et al, 1974; Dawson et al, 1985).

Such is not the case in LMIC. Repair of such sophisticated equipment requires (a) parts and (b) expertise; neither of which are likely to be available. Even in the unlikely event of having availability of many spare parts in-country, the correct part must first be determined and then installed by workers on site. Finally, in today’s sophisticated environment, spare part pipelines are assumed in most high-income countries; this is not globally true. It is unlikely that a large collection of spare linac parts are either available or readily accessible from any LMIC.

**Radiotherapy-Unique**

Just as surgeons require assistants facile with surgical and sterilization techniques, and medical oncologists require specially trained nurses to deliver chemotherapy, radiotherapy presumes several other professional cadres. Medical physicists are critical not simply for commissioning and...
preventive maintenance on the equipment, but also for constant and time-consuming quality assurance as required nationally (Klein et al, 2009), and sophisticated and complex treatment plans required by the discipline. A recent IAEA survey in Europe uncovered issues in physics or dosimetry in 10% of cases (Sengheavuth et al, 2014), so in addition to the physics training inherent in being a medical physicist, significant experience is required as well.

Manpower issues are critical in every countries with rapidly developing Radiotherapy technologies (Miller, 2005; Mills et al, 2006), but even bleaker in LMIC countries. IAEA and WHO have been trying to train therapists, physicists and radiation oncologists via an annual program held in Trieste, however such efforts are a drop in the bucket (IAEA, 2008; IAEA Human Health Series No. 14, 2010; WHO, 2002) compared to the need. These issues are being discussed about in many editorials (Coleman et al, 2015; Coleman et al, 2014; Zietman, 2014); to date most training initiatives are with assistance from private and donor institutions from developed countries.

**LINAC versus Cobalt?**

Once a nation feels comfortable with the challenges inherent in a national radiotherapy presence, the next major issue is what technology to incorporate. This is not a subtle concept. Where LINACs are sophisticated and complex to operate, the alternative, cobalt machines, use the gamma rays emitted from radioactive cobalt in the head of the equipment to provide therapy. The relative pros and cons of each have been reviewed several times, including recently (Page et al, 2014). Linacs are usually preferable for dosimetric precision, but cobalt treatment units may be more flexible regarding power sources, simplicity of maintenance, and ease in training.

With surgery and chemotherapy, radiotherapy plays an integral role in the management of cancer. Nearly 40% of patients in high-income countries require radiotherapy at some point in their care (IAEA, 2008). Radiation therapy isdivided into 2 categories; teletherapy for broader use using cobalt, and oesophagus. Teletherapy machines provide the vast majority of radiotherapy usage. Various international reports discuss the planning and sophisticated and complex treatment plans required by the discipline. A recent IAEA survey in Europe uncovered issues in physics or dosimetry in 10% of cases (Gershkevitsh et al, 2014); so in addition to the physics training inherent in being a medical physicist, significant experience is required as well.

The following table summarizes these points.

### Table 1: Comparison between Cobalt-60 unit and Linear accelerator (LINAC) characteristics

<table>
<thead>
<tr>
<th>Cobalt-60 Unit</th>
<th>Linear Accelerator</th>
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<tbody>
<tr>
<td><strong>What doses are adequate?</strong></td>
<td>No limitations if AP/PA treatment, optimum thickness &lt;25 cm</td>
</tr>
<tr>
<td><strong>Depth of treatment</strong></td>
<td>Cannot treat deep seat tumors due to source design. Consider source replacement at ~1 year</td>
</tr>
<tr>
<td><strong>Isotopes &amp; training</strong></td>
<td>Short 4-week training required</td>
</tr>
<tr>
<td><strong>Personnel &amp; training</strong></td>
<td>Low-dose, narrow training required</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Initial Investment</strong></td>
<td>Cobalt unit is nearly 1/8 the cost of linear accelerator</td>
</tr>
<tr>
<td><strong>Costs per treatment</strong></td>
<td>~$ 0.001/MBq. Minimum installation cost</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Minimum. Source replacement ~3/8/10Y</td>
</tr>
<tr>
<td><strong>Stability</strong></td>
<td>High, stable dose rate, no maintenance</td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Service parts &amp; targets</strong></td>
<td>Various &amp; &amp;</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Requires a steady environment</td>
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</table>

**Based on the data in Table 1, a logical recommendation for LMIC can be made in favour of Cobalt units based on following:**

- **Maintenance cost:** Cobalt units are nearly 1/8 the cost of linear accelerator
- **Maintenance cost including parts and repairs:** nearly 1/10 the cost of linear accelerator.
- **Manpower and training:** Less demanding.
- **Uncertain power supply in most of Africa:** Less downtime.

However, there are some unique features in linear, such as multileaf collimator (MLC), electronic portal imaging (EPI), and on-board imaging (OBI) that are essential for modern and advanced treatment techniques. It is understood that palliation would be the initial need for radiotherapy in any LMIC developing a nascent cancer control program, so such sophistication may not be necessary. In such a case, Co-60 is a good choice. There are new developments in providing such tools on Co-60 thus making it suitable and cost effective treatment (Langhans et al, 2015).

**Disruptive Influence and Potential for LMIC**

A recent article in the Harvard Business Review is apropos to the circumstances of radiotherapy in LMIC. The discussion begins with a description of a novel wheelchair; 80% faster and 40% more efficient to propel than conventional wheelchairs, though it is manufactured from parts available at a bicycle shop. It can handle the varied terrain found in LMIC as well as being suitable for indoor use. Finally, it costs only about $250.

The background to this product is instructive for radiotherapy vendors. The problem with the current radiotherapy vendor universe is that it is very narrow (fewer than 5 large vendors), highly focused on global partners with sophisticated infrastructures. Such equipment does not well translate or transport or even exist well in countries without. It is encouraging to think what such an entrepreneurial perspective could bring to the table with 18% of the world’s economies and 82% of the world’s populations at risk.

**References**


Cancer chemotherapy is a vital part of effective cancer treatment. In some diseases, among them Burkitt Lymphoma or Acute Lymphocytic Leukemia it is essential for cure. The medical oncologist uses a number of drugs to treat cancer. Often the patient will regularly receive three or four in combination over a period of months. Thirty-eight chemotherapeutic drugs and six hormones are commonly used (Table 1) to treat the common treatable cancers with high population impact (Table 2). (Shulman et al, 2016; World Health Organization, 2015) These drugs have been judged essential for good care. Unfortunately many of these drugs are commonly not available to many cancer patients in Africa.

Table 1: Essential Medicines 19th edition WHO Model List

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<tr>
<th>Cytotoxic and adjuvant medicines</th>
<th>Capsule: 10 mg</th>
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<tr>
<td>all-trans retinoic acid (ATRA)</td>
<td>acute promyelocytic leukemia</td>
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<td>allopurinol</td>
<td>Tablet: 100 mg, 300 mg</td>
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<tr>
<td>asparaginase</td>
<td>powder for injection: 10 000 IU in vial</td>
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<tr>
<td>bendamustine</td>
<td>powder for injection: 15 mg (as sulfate) in vial</td>
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<tr>
<td>bleomycin</td>
<td>powder for injection: 1 mg in vial</td>
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<tr>
<td>etoposide</td>
<td>powder for injection: 10 mg (as sulfate) in vial</td>
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<tr>
<td>Fludarabine</td>
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<tr>
<td>Cytotoxic and adjuvant medicines</td>
<td>Dosage Form</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>dacarbazine</td>
<td>Powder for injection; 100 mg in vial</td>
</tr>
<tr>
<td>dactinomycin</td>
<td>Powder for injection; 500 micrograms in vial</td>
</tr>
<tr>
<td>daunorubicin</td>
<td>Powder for injection; 50 mg (hydrochloride) in vial</td>
</tr>
<tr>
<td>docetaxel</td>
<td>Injection; 20 mg/mL; 40 mg/mL</td>
</tr>
<tr>
<td>doxorubicin</td>
<td>Powder for injection; 10 mg; 50 mg (hydrochloride) in vial</td>
</tr>
<tr>
<td>etoposide</td>
<td>Capsule; 100 mg</td>
</tr>
<tr>
<td>fludarabine</td>
<td>Powder for injection; 50 mg (phosphate) in vial; Tablet: 10 mg</td>
</tr>
<tr>
<td>fluorouracil</td>
<td>Injection; 50 mg/mL in 5 mL ampoule</td>
</tr>
<tr>
<td>calcium folinate</td>
<td>Injection; 3 mg/mL in 10 mL ampoule</td>
</tr>
<tr>
<td>capecitabine</td>
<td>Tablet: 150 mg; 500 mg</td>
</tr>
<tr>
<td>carboplatin</td>
<td>Injection; 50 mg/5 mL; 150 mg/15 mL; 400 mg/40 mL; 600 mg/60 mL</td>
</tr>
<tr>
<td>chlorambucil</td>
<td>Tablet: 2 mg</td>
</tr>
<tr>
<td>cisplatin</td>
<td>Injection; 50 mg/mL; 100 mg/100 mL</td>
</tr>
<tr>
<td>cytarabine</td>
<td>Powder for injection; 100 mg in vial</td>
</tr>
</tbody>
</table>
### Cytotoxic and adjuvant medicines

**Paclitaxel**
- Powder for injection: 200 mg/mL in 1 mL vial, 1 g vial
- Cytotoxic and adjuvant medicines
- epithelial ovarian cancer
- early stage breast cancer
- metastatic breast cancer
- Kaposi’s Sarcoma
- nasopharyngeal cancer
- non-small cell lung cancer
- ovarian germ cell tumour

**Procarbazine**
- Capsule: 50 mg (as hydrochloride)

**Rituximab**
- Injection: 100 mg/10 mL in 10 mL vial; 500 mg/50 mL in 50 mL vial
- Cytotoxic and adjuvant medicines
- diffuse large B-cell lymphoma
- chronic lymphocytic leukemia
- follicular lymphoma

**Tioguanine**
- Solid oral dosage form: 40 mg
- acute lymphoblastic leukemia

**Trastuzumab**
- Dose form:
  - early stage HER2 positive breast cancer
  - metastatic HER2 positive breast cancer

**Vinblastine**
- Powder for injection: 10 mg (sulfate) in vial
- Cytotoxic and adjuvant medicines
- Hodgkin lymphoma
- Kaposi’s Sarcoma
- Testicular germ cell tumour
- Ovarian germ cell tumour

**Vincristine**
- Powder for injection: 1 mg; 5 mg (sulfate) in vial
- Cytotoxic and adjuvant medicines
- diffuse large B-cell lymphoma
- gestational trophoblastic neoplasia
- Hodgkin lymphoma
- Kaposi’s Sarcoma
- follicular lymphoma
- retinoblastoma
- rhabdomyosarcoma
- Ewing’s Sarcoma
- acute lymphoblastic leukemia
- Wilms tumour
- Burkitt lymphoma

**Vinorelbine**
- Injection: 10 mg/mL in 1 mL vial; 50 mg/5 mL in 5 mL vial
- Cytotoxic and adjuvant medicines
- non-small cell lung cancer
- metastatic breast cancer

**Filgrastim**
- Injection: 120 micrograms/0.2 mL; 300 micrograms/0.5 mL; 480 micrograms/0.8 mL in pre-filled syringe 300 micrograms/mL in 1 mL vial, 480 mg/1.6 mL in 1.6 mL vial
- Cytotoxic and adjuvant medicines
- As primary prophylaxis in patients at high risk for developing febrile neutropenia associated with myelotoxic chemotherapy
- As secondary prophylaxis for patients who have experienced neutropenia following prior myelotoxic chemotherapy
- to facilitate administration of dose dense chemotherapy regimens

**Gemcitabine**
- Powder for injection: 500 mg in vial, 1 g in vial
- Cytotoxic and adjuvant medicines
- epithelial ovarian cancer
- non-small cell lung cancer

**Hydroxyurea**
- Capsule: 500 mg

**Iclusig**
- Tablet: 100 mg, 400 mg
- Cytotoxic and adjuvant medicines
- chronic myeloid leukemia
- gastrointestinal stromal tumour

**Irinotecan**
- Injection: 40 mg/mL in 1 mL vial, 180 mg/mL in 5 mL vial, 500 mg/mL in 50 mL vial
- Cytotoxic and adjuvant medicines
- metastatic colorectal cancer

**Mecamylamine**
- Tablet: 50 mg
- Cytotoxic and adjuvant medicines
- acute lymphoblastic leukemia
- acute myelogenous leukemia

**Mesna**
- Powder for injection: 100 mg/mL in 10 mL ampoules; 500 mg/mL in 10 mL ampoules
- Table: 400 mg, 600 mg
- Cytotoxic and adjuvant medicines
- testicular germ cell tumour
- ovarian germ cell tumour
- osteosarcoma
- rhabdomyosarcoma
- Ewing’s Sarcoma

**Methotrexate**
- Powder for injection: 50 mg (as sodium salt) in vial
- Table: 3.5 mg (as sodium salt)
- Cytotoxic and adjuvant medicines
- early stage breast cancer
- gestational trophoblastic neoplasia
- osteosarcoma
- acute lymphoblastic leukemia
- acute myelogenous leukemia

**Merthiolate**
- Powder for injection: 50 mg (as sodium salt) in vial
- Table: 3.5 mg (as sodium salt)
- Cytotoxic and adjuvant medicines
- early stage breast cancer
- gestational trophoblastic neoplasia
- osteosarcoma
- acute lymphoblastic leukemia
- acute myelogenous leukemia

**Vindesine**
- Injection: 10 mg/mL in 5 mL vial
- Cytotoxic and adjuvant medicines
- gestational trophoblastic neoplasia
- acute lymphoblastic leukemia
- acute myelogenous leukemia
- retinoblastoma
- Burkitt lymphoma

## Chapter 7 - African Medical Oncology
Indeed, the effective treatment of many cancers is multi-disciplinary, requiring surgery, radiation and cancer chemotherapy. These disciplines and especially cancer chemotherapy, require many other resources for support. Among them, are pathologic and laboratory analysis for diagnosis and receptor assay, radiologic imaging for staging and assessment of response, and supportive care services such as blood banking and nutrition counseling. Supportive care takes the form of drugs including anti-emetics and antibiotics. Some important support for chemotherapy is often not readily apparent. For example, pharmacists and pharmacy technicians are needed to prepare intravenous chemotherapy drugs. Specialized equipment is also needed, for example exhaust hoods are used so that drug preparation can be done safely and infusion lines and infusion pumps are needed for drug administration.

Drugs are often not available in low income and low middle income. A pharmaceutical company invests in a medicine based on its anticipated income. There is little financial incentive to seek approval to sell drugs in many low and middle-income countries. This is especially true in African countries where one dose of a chemotherapeutic can cost more than the average individual income. Availability can be limited due to a number of factors beyond cost and profitability. These include issues with a country’s drug approval system, the logistics of importation and distribution and the lack of technology needed to support the use of the drug.

Some countries require an application for approval. This is a notoriously slow process in many African countries. It can often take three to four years after approval in the United States or European Union. Some countries will accept United States or European Union approval of the drug, but some require local review and a small number even require local clinical development. Local clinical development is a common requirement of the Japanese government but rare in Africa. It may become more necessary in Africa in the future as drugs become more personalized or tailored.

Drug importation is often laborious and expensive. The company often must pay the receiving country’s government inspection fees. Even after drug approval, there are often importation difficulties as the importer must document the chain of custody of the drug and that it has gone through Good Manufacturing Practice. Even with this, many countries do not have the infrastructure to guarantee the quality, efficacy and safety of medicines. In a 2015 survey of the 14 countries of the Southern African Development Community (Lesotho, Swaziland, Seychelles, DRC, Angola, Malawi, Mozambique, Zambai, Botswana, Mauritius, Namibia, South Africa, Tanzania, Zimbabwe), most National Medicine Registration authorities were unable to perform full regulatory function (dossier evaluations and registration, GMP inspection) after drug approval, there are often importation difficulties as the importer must document the chain of custody of the drug and that it has gone through Good Manufacturing Practice. Even with this, many countries do not have the infrastructure to guarantee the quality, efficacy and safety of medicines. In a 2015 survey of the 14 countries of the Southern African Development Community (Lesotho, Swaziland, Seychelles, DRC, Angola, Malawi, Mozambique, Zambai, Botswana, Mauritius, Namibia, South Africa, Tanzania, Zimbabwe), most National Medicine Registration Authorities were unable to perform full regulatory function (dossier evaluations and registration, GMP inspection) and receive approval. In many countries the drug cost (not including cost of administration) for one round of chemotherapy can be more than the average individual income.

Table 2: Priority Cancers for the 19th WHO Essential Medicines List

<table>
<thead>
<tr>
<th>Adult Cancers</th>
<th>Pediatric Cancers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Lymphocytic Leukemia</td>
<td>Acute Lymphoblastic Leukemia</td>
</tr>
<tr>
<td>Blast Pharyngeal Cancers</td>
<td>Burkitt Lymphoma</td>
</tr>
<tr>
<td>Breast Cancer, Early Stage</td>
<td>Brain Lymphoma</td>
</tr>
<tr>
<td>Chronic Lymphatic Leukemia</td>
<td>Ependymoma</td>
</tr>
<tr>
<td>Chronic Leukemia, Early Stage</td>
<td>Gastrointestinal Stomal Tumor</td>
</tr>
<tr>
<td>Chronic Lymphoma, Leukemia</td>
<td>Gastrointestinal Neuroblastoma</td>
</tr>
<tr>
<td>Chronic Myelogenous Leukemia</td>
<td>Head and Neck Cancer</td>
</tr>
<tr>
<td>Chronic Myeloid Leukemia</td>
<td>Hodgkin Lymphoma</td>
</tr>
<tr>
<td>Chronic Myelofibrosis Resevoir</td>
<td>Kaposi’s Sarcoma</td>
</tr>
<tr>
<td>Gastrointestinal Neuroblastoma</td>
<td>Nasal and Respiratory Lymphoma</td>
</tr>
<tr>
<td>Gastrointestinal Neuroblastoma</td>
<td>Non-Small Cell Lung cancer</td>
</tr>
<tr>
<td>Gastrointestinal Neuroblastoma</td>
<td>Osteosarcoma</td>
</tr>
<tr>
<td>Gastrointestinal Neuroblastoma</td>
<td>Pancreatic Cancer</td>
</tr>
<tr>
<td>Gastrointestinal Neuroblastoma</td>
<td>Rectal Cancer, Early Stage</td>
</tr>
<tr>
<td>Gastrointestinal Neuroblastoma</td>
<td>Rectal Cancer, Early Stage</td>
</tr>
</tbody>
</table>

The American or European price of many cancer medicines is unaffordable for most Africans. In many countries the drug cost (not including cost of administration) for one round of chemotherapy is more than the average individual annual income.
Gross National Income per capita is a rough estimate of average annual income for a country's citizens. It is used to classify countries as low income, lower middle income, upper middle income or high income. Most African countries are classified as low income or lower middle income. A low income country has a Gross National Income per capita less than 1,025 USD and a lower middle income country has a has a GNI per capita up to 4,035 USD. A few are categorized as upper middle income (among them: Angola, 5,300 USD, Namibia, 5,820 USD; South Africa 6,800 USD). (World Health Organization, 2016)

Country approval for sale of a drug does not mean all patients have access to medicine. It means a small number of wealthy patients will be able to pay for it in the private sector. Separate from approval, the country's Ministry of Health must adopt the drug to a national formulary of medicines in order for it to be available in the public hospitals. Many Health Ministries consider drugs on the World Health Organization Essential Medicines List for inclusion on formularies for public hospitals.

The WHO publishes the Essential Medicines Lists in an effort to improve quality of care for a number of common diseases. Essential medicines, as defined by the WHO are "those drugs that satisfy the health care needs of the majority of the population; they should therefore be available at all times in adequate amounts and in appropriate dosage forms, at a price the community can afford."

The list is updated every two years. The process of creating the list looks at the population impact of a disease as well as the efficacy of drugs on that disease. The cost and value of a drug is considered when evaluating it as is the support burden required to administer the drug. Preference is given to curative treatments and treatments that can provide palliation. An expensive adjuvant cancer therapy that increases median survival by three months and consumes many hospital resources is not weighted as high as a four-drug combination that can cure a disease.

In developing the cancer drugs for the list, the committee considers regulatory issues, supply chain management, quality assurance, training of personnel, service delivery. Cost and use scenarios are considered. Estrogen receptor testing is relatively simple and inexpensive. The drug tamoxifen and the SERMs are relatively inexpensive drugs that are quite effective in prolonging life. Erlotinib and Gefitinib for Non Small Cell Lung Cancer does prolong life, but were rejected because clinical effect is shorter; they are relatively expensive and there is a scarcity of laboratories capable of doing needed molecular essays.

Health Ministries trust that a regulatory body has evaluated drugs on the WHO EML to assure efficacy, safety and value. (Doua et al, 2014) Inclusion on the list can provide some assurances replacing need for a formal country specific approval process. It is estimated that 90% of LMIC Health Ministries use the WHO EML to establish a national formulary and for public procurement. Factors in the decision to put a drug on the WHO EML are "those drugs that satisfy the health care needs of the majority of the population; they should therefore be available at all times in adequate amounts and in appropriate dosage forms, at a price the community can afford."

The WHO EML lists the drug, its commonly used dose, and its formulation. In the case of cancer drugs, those on the EML are traceable to the type of cancer. The EML's list is updated every two years. The process of creating the list looks at the population impact of a disease as well as the efficacy of drugs on that disease. The cost and value of a drug is considered when evaluating it as is the support burden required to administer the drug. Preference is given to curative treatments and treatments that can provide palliation.

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References


As clinicians we often forget to take the public health approach as to how we are dealing with the needs of communities. Yet nowhere in the world is this more important than in the African continent where more than 50% of the patients never reach a health worker. This is the stark reality! Yet at conferences, eloquent clinicians often speak as if everyone in Africa had the same opportunities as in the more affluent countries. Thus we teach often from the books published from these advanced countries, expecting our patients to receive the same treatments. In our personal experience, but not yet documented, most cannot afford these treatments and about 80% get better without treatment anyway. Some of these patients are in the 2-3% aged over 65 of most African countries (Central Intelligence Agency, 2015). Between 10 and 20% of those prescribed treatment are unable to pay, either die or are left with terrible suffering and poor quality of life for them and their families.

"But if we zone into cancer care in Africa, surely should we be treating the felt needs of the patient throughout the disease trajectory."

In 1986, the WHO stated and repeated in 1996: “In most parts of the world, the majority of cancer patients present with advanced disease. For them the only realistic treatment is pain relief and palliative care” (WHO, 1996).

How is Africa doing here? For the 5% that reach curative therapy, we need our oncologists to realise the public health approach required for cancer patients and to be focusing on the quality of life for the patient and family, rather than carrying out painful curative therapy up to the last day of life. For the 80-90% who die at home with dreadful suffering we need improved palliative care reaching out to the communities in each country (WHO, 1986) with the backing of the oncologists and Governments.

This chapter will cover the state of palliative care (PC) in Africa by January 2016 as a starting point for a more rapid progress in improving pain control and the quality of life of cancer patients in Africa.
What is Palliative Care?

"Palliative care is an approach that improves the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual” (World Health Organization, 2002).

The reference to suffering includes physical pain but also suffering associated with end of life, including psychological, social (including economic), spiritual and cultural suffering. But these latter areas cannot be even talked about in the presence of severe physical pain. Thus the identification and relief of physical pain through the use of affordable oral morphine has now made palliative care possible in African countries. But the barriers associated with myths regarding morphine must be overcome within our health professionals and our Governments. Sadly those who impose the restrictions on morphine use, from Global to National leaders, have never visited a patient with untreated and advanced cancer trying to cope at home. Thus they cannot have the compassionate approach required, as compassion needs empathy before action.

Case Report: Sam

This is a case reported in the papers in one of our countries:

Sam is 15 years old and about to do his O levels. A year ago he noticed a problem with his left eye. A swelling came across it until he could no longer see. This spread to the right eye and has steadily grown to present size when reported on. He had been to three hospitals supported by good neighbours as he was from a very poor family. There was only one oncology unit in the country and he lived 50 miles away. He was first referred there, but each time he went early in the morning the doctor who came would leave on the dot of 12 (for his private practice) and he would be told to come the following week. This happened five times until the person supporting them suggested trying another hospital. The second hospital referred him back to the first hospital and the whole saga began again. He never actually saw a doctor there until it was too late. He told his father: “let me just go home, this is too much”.

Sam’s mother earned a small amount as a carer at a school and his father was a subsistence farmer. He would take him for hospital visits. The local neighbours tried all they could to help him financially, but it was in vain, and cost a lot of money.

He eventually managed to get relief from a palliative care team. This was in one of the 20 countries presently with oral morphine and he died with relief of physical pain through the use of affordable oral morphine has now made palliative care possible in African countries. But the barriers associated with myths regarding morphine must be overcome within our health professionals and our Governments. Sadly those who impose the restrictions on morphine use, from Global to National leaders, have never visited a patient with untreated and advanced cancer trying to cope at home. Thus they cannot have the compassionate approach required, as compassion needs empathy before action.

Evidence of Outcomes in Oncology vs. Palliative Care: Divided we Fall… United we Stand?

The impression we get from African countries, is that our oncologists are mainly focused on “cure”! Cure is success and death is a failure. Cure is measured in the length of time a patient lives after treatment. There is little reference to quality of life. Perhaps we should re-assess our measurable outcomes.

For many years, those in palliative care have recognised that patients who receive palliative care live longer than those who do not. Once pain is relieved and their holistic needs are being met, the patient eats and sleeps better and thus lives longer with a better quality of life, and more likely to die at peace with their family, friends and their God. This is the recommended approach from WHO.

Since the first paper with proven evidence came out in 2010 (Ternel et al, 2010), showing that “compared with patients receiving standard care, patients receiving early palliative care had less aggressive care at the end of life AND longer survival”, several others have appeared.

One publication in Biomed Central, summarised their advice to oncologists as follows:

“Continuing chemotherapy for advanced non-small cell lung cancer (NSCLC) until very near death is associated with a decreased likelihood of receiving hospice care, but not prolonged survival. Oncologists should strive to discontinue chemotherapy as death approaches and encourage patients to enroll in hospice for better end-of-life palliative care” (Saito et al, 2011).

Two further studies in Journals of Clinical Oncology suggest that early referral to palliative care not only improves quality of life but also reduces costs (May et al, 2015; Sher, 2015). A literature review has indicated that palliative care is most frequently found to be less costly relative to comparator groups, and in most cases, the difference in cost is statistically significant (Smith et al, 2014).
The WHO has recommended for many years that palliative care should be introduced at diagnosis and given alongside curative/palliative treat-
ments. Yet many African oncologists, or others using “curative” therapies, tend only to refer their patient when curative therapy has failed, if at all.

Thus affordable palliative care in Africa is particularly important as it can be given in the communities where the patients and families in Africa
wish to live and die coming to the end of life (Sepulveda et al, 2003).

History of Palliative Care in the World

Palliative care, as first known as “Hospice Care” from 1667, following the opening of St Christopher’s Hospice in London by Dame Cicely Saunders
(Cicely Saunders International, 2016; Merriman et al, 2018) – the founder of modern palliative care (left).

The word Hospice comes from the Latin “hospitium” or the Greek “hopegos” meaning hospitality. This denotes that those who come to such facil-
ities are treated as guests. But Hospitals are far from guest houses today where patients are expected to do as they are told, and in Africa, often
asked to sign themselves out if they are not complaint to doctor’s orders!

The WHO has recommended for many years that palliative care should be introduced at diagnosis and given alongside curative/palliative treat-
ments. Yet many African oncologists, or others using “curative” therapies, tend only to refer their patient when curative therapy has failed, if at all.

Palliative care reached each continent in turn, it was found that the word “hospice” had dreadful meanings. In Canada the Hospice was a
building within walls where there was very little true care and people dreaded being admitted there. Thus Dr Balfour Mount, coined the term
“palliative care” to take the place of “hospice care” so that Dame Cicely’s new approach of holistic care could be embraced in this new specialty.
Thus we now hear mainly about palliative care and palliative medicine. The word palliative care comes from the word “pall” a Latin word meaning
covering or blanket. It has been interpreted by the comfort given in all the multiple symptoms both medical, social, psychological, cultural and
spiritual which are present in the critically ill and dying.

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spiritual which are present in the critically ill and dying.

In Singapore, Hospice was related to Sago Lane, a road for the dying and the dead. It was unlucky in Chinese culture for someone to die in the
house and often the house was abandoned after the death. Thus when a person was considered to be dying the house was abandoned in Sago
Lane. Next door was the undertaker and after that the cemetery. The dying were not well cared for and most dreaded this place seeing it as the
conveyor belt to the cemetery. When we tried to commence hospice in Singapore there was fear that we were multiplying this form of care. It was
the publication of the WHO book in 1986, and the recognition that loved ones were dying in pain in Singapore when the rest of the world knew
how to control it, that allowed palliative care to commence and it has since prospered.

Hospice/palliative care from the start covered all ages in need. In recent years paediatric palliative care has become a specialty in its own right and
we are getting better at the care of the developing child Palliative care is also becoming part of geriatric medicine in those countries where dying
is most among the elderly and has been extended also to psycho geriatric medicine. Initially commenced for patients with cancer, palliative
care in the west is now open to all conditions leading to the end of life. The HIV epidemic brought palliative care to infectious diseases and now
is becoming a large part of care for those with non-communicable diseases.

The History of Palliative Care in Africa

Modern palliative care commenced when the pioneer Dame Cicely Saunders opened St Christopher’s Hospice in London in 1967. It took 12 years
to first reach Africa. Zimbabwe commenced with Island Hospice, in 1979 and South Africa commenced with St Lukier Hospice, Cape Town in 1980
(Hickman, 2009). These were then among the most affluent African countries. There was then a gap of ten years before palliative care was to take
off again. This was in spite of WHO in 1986 stating that oncology would not be available to all in the resource poor countries for generations to
come, and recommending that palliative care was the only affordable and humane approach to the suffering of cancer in these countries.

It was from 1990 with the opening of Nairobi Hospice in Kenya, and the inspiration derived from witnessing the terrible suffering there that
inspired Hospice Africa, that palliative care began to move throughout the poorer African countries. Since then 35 African countries (out of 54)
know about palliative care but only 20 of these have oral morphine and 15 affordable oral morphine. The morphine story is now part of the
history of palliative care in Africa and will be discussed later.

Meanwhile other landmarks in palliative care were occurring worldwide. In 1986 the WHO produced their bestseller Cancer Pain Control (WHO, 1986) which first discussed the role of the analgesic ladder. The following year, palliative medicine was declared a specialty under the Royal
Colleges of Medicine in United Kingdom and Ireland. It took another 20 years for the United States to declare it a specialty. In Africa it is yet to be
recognised as a specialty in the majority of countries.

This chapter will look at the state of palliative care in Africa in 2016 (Figures 2 and 3). Its relationship to other specialties and the reason for the
greater need in resource strapped countries where less than 5% of cancer patients reach oncology and 50% of Africans do not reach health
services.
How have Palliative Care Programmes Commenced in African Countries?

Palliative care has usually been commenced by an individual who is inspired by compassion. Having seen the suffering of the African families when a loved one is dying of cancer, in agony, and then having seen that something is being done in other countries, they have brought this idea back to their own country. Initially such persons were inspired from seeing St Christopher’s in London where Dame Cicely had started the modern Hospice Movement. Once palliative care had moved to other continents, some were equally inspiring. However coming back to Africa, the greatest obstacle for commencing such a service was the economy. Palliative care had become expensive when compared to medical services allowances in African countries. Examples of this are seen in Nigeria, where Mrs Fatumbi, a Nurse in Lagos, visited St Christopher’s Hospice, and returned to Nigeria convinced she might bring this approach to the suffering of her own people, in Lagos. But not only was there no funds, but there was huge opposition to having available opioids or other medications for severe pain. Thus the only patients that she could help were those who returned from treatment in other countries brining their own supply of medications. Some died before medications ran out but others survived beyond the medications and were thrown back into pain.

This experience was repeated as others returned to their countries and realised without funds the United Kingdom or United States model would not work for them either.

Since affordable oral morphine came in and it was possible to create an affordable African model, palliative care is being taken up by many non-governmental organisations (NGOs) supported by governments with policy, but very few with any funding or material support. Uganda, the only country to give free oral morphine and to allow nurses trained in palliative care to become prescribers of morphine, provides encouragement for other countries now taking up the WHO resolution of 2016.

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Palliative care has usually been commenced by an individual who is inspired by compassion. Having seen the suffering of the African families when a loved one is dying of cancer, in agony, and then having seen that something is being done in other countries, they have brought this idea back to their own country. Initially such persons were inspired from seeing St Christopher’s in London where Dame Cicely had started the modern Hospice Movement. Once palliative care had moved to other continents, some were equally inspiring. However coming back to Africa, the greatest obstacle for commencing such a service was the economy. Palliative care had become expensive when compared to medical services allowances in African countries. Examples of this are seen in Nigeria, where Mrs Fatumbi, a Nurse in Lagos, visited St Christopher’s Hospice, and returned to Nigeria convinced she might bring this approach to the suffering of her own people, in Lagos. But not only was there no funds, but there was huge opposition to having available opioids or other medications for severe pain. Thus the only patients that she could help were those who returned from treatment in other countries brining their own supply of medications. Some died before medications ran out but others survived beyond the medications and were thrown back into pain.

This experience was repeated as others returned to their countries and realised without funds the United Kingdom or United States model would not work for them either.

Since affordable oral morphine came in and it was possible to create an affordable African model, palliative care is being taken up by many non-governmental organisations (NGOs) supported by governments with policy, but very few with any funding or material support. Uganda, the only country to give free oral morphine and to allow nurses trained in palliative care to become prescribers of morphine, provides encouragement for other countries now taking up the WHO resolution of 2016.
Since 2000, more countries have come forward with a Champion wishing to commence palliative care in their own country and sometimes their own village! Most are not trained in palliative care and need to attend at least the initiators course (International Programmes, HAU) to grasp the multifactorial aspects of this new specialty and carrying it out within their own economy and culture.

**How African Services are Started so far**

Palliative care commences with the first patient seen and helped holistically, and not with the Government policy. Government policies are important, but they should arise from the knowledge of the needs of patients in that country rather than Government officials. No patient should be allowed to suffer while awaiting a policy. We must all be prepared to learn from our patients!

Some have started by one person with no previous knowledge but have witnessed good palliative care (Figure 8). Others have commenced with inspiration and experience and helped others. Some have been in palliative care and others in other cancer or non-cancer specialities.

In particular, anaesthetists who have been involved in pain clinics and post-operative pain and concerned over the lack of pain control, have become involved and are doing very well. This is particularly well in Nigeria.

These are some of the prerequisites for palliative care initiation:

**Inspiration**

Inspiration to inflame fire in the belly: it is recommended that palliative care commences with someone already trained in palliative care. However seeing the different ways a service has commenced in African countries, we can see that many times a person, with compassion for the suffering seen among cancer/AIDS or other patients has stirred or inspired them to support the commencement of a service to prevent/treat suffering in their own country.

**The Public Health Approach**

It is useful to have knowledge of the pillars of the public Health approach needed for a new service. These are drug availability (the first priority especially for oral morphine available in the home), a service which reaches out to the community so there is no break in treatment and care once commenced, and a service from which we can teach so that palliative care spreads beyond the scheduled catchment area of this service. The service ideally commences with the blessing of the Government through the Ministry of Health. However some have commenced a support service and later received this support.

**Knowing the Difference Between Palliative Care and Support Care**

Before 1967, patients who were critically or chronically ill or approaching the end of life were given “support” care. Modern Hospice care later named ‘palliative care’ commenced when management of pain in these patients was researched then taught and practised. Dame Cicely brought this medical knowledge to the world following her personal research in St Joseph’s Hospice in London before commencing St Christopher’s in 1967. She was the first to recognise “total pain” which meant not just physical pain but so many other aspects of suffering in the time before death. But the other aspects of suffering could not be reached without first controlling severe physical pain occurring in at least 80% of cancer patients.

**Some Knowledge and a Willingness to Learn**

Every patient is different. They have lived with their bodies all their lives and know if anything does not suit them. They also have beliefs that may prevent them from accepting certain medications or advice. We must respect this, listen to their preferences and trust them as a guest unless their preferences is doing them harm, then advise gently, while keeping their confidence. We need to consider the following:

- The needs of patients and the factors that affect care, approach to end of life and customs surrounding death according to culture and religious practice; spirituality and the relevance of this when a person is dying in Africa and locally.
- Health and illness behaviour affecting use of medical services. The percentage of the population who do not reach a health service and why? Where are they? What are their preferences for this time before death? Understanding how health behaviour is affected by spiritual beliefs, new and old religious and cultural beliefs Alternative health behaviours? Are they using traditional health services: herbal versus witch doctors? Where would they like to be before death?
- The public health needs of each country need to be tailored to knowing preferences, including where patients and families wish to die, how culture and spirituality affect the critically ill and those at end of life, and a recognition as to where patients are, when in Africa at least 50% of patients do not reach hospitals. Our service must reach the patient where he/she is. Remembering that many are too sick to travel.
- The elements of pain and symptom control management and managing these at home: these are simply defined in the “Blue Book” (Merriman et al, 2012) of Hospice Africa, which has been the basis for teaching PC in most African countries today. Other books have been written from different angles and using experiences of more affluent countries, but in training the simpler forms for Africa need to be introduced and understood so that they can apply only what is relevant to their own country and not introduce expensive methods of treatment with no possibility of sustainability.

**Counting the Cost**

This will depend very much on how you plan to start. The two most successful palliative care services in Uganda commenced with a huge difference in funds available to them. Hospice Africa Uganda, 1993, founded for cancer but taking on AIDS patients by the second year, commenced with enough funding for three months for three team members, relying on Ugandan people to lend them rent free accommodation in which both to live and see patients. Having told people of their work and individual patient stories showcasing the terrible suffering as well as the caring of Ugandan members of the team, funding began to trickle in, mainly from international donors in the United Kingdom and, fund as well as from individuals and later two charity shops in Muyessese. This allowed Hospice Africa Uganda to expand. In 1996, Mildmay, founded for palliative care and service to HIV patients, commenced but before opening its doors it had received donated land from government of Uganda supported by the British government through the Department for Internal Development and a state of the art facility for their service and training, funded by the British Government for two and a half years. Both have been successful in bringing palliative care to many countries in Africa.

**Right: A volunteer prepares to visit a patient**

**Left: Typical slum in an African city where volunteers and palliative care teams go to care**

Vision and Mission

It is essential to have a well thought out vision, before commencing and to be committed to see this through. The mission will develop from the vision and objectives can be clearly defined. In resource restricted countries, there is a huge temptation to move away from the mission in order to access funds from donors who have their own agendas, often diverting away from the founding vision. This has caused many palliative care services in Africa to fail or to become diverted into other areas to please the donors so the palliative care either becomes low standard (away from the “impecable service” in the definition of palliative care of WHO), or be diverted into another cause altogether.

The founders must be convinced of the need for palliative care in their area and be able to bring this need to the attention of their Government. This needs to be backed up with statistics that prove, and experience which can demonstrate the terrible suffering of the sick their country or area. A situation analysis should be carried out early after the start of the service, reflecting the preferences of patients and families at this time of life. The service should reflect and be assured of the essentials of the public health approach (see below) i.e. service, medications and training with Government approval and later strengthened by policy. If possible a trained person in African palliative care should be one of the initial team. African Palliative care, by economic necessity and special skills and time required, is a nurse led specialty. Their experiences with patients are taken into account before making organisational decisions affecting patients and families.

Teaching can commence immediately, once the team includes palliative care professionals. This begins with teaching of families in caring, training of community volunteers in identifying and referring those in need, to appropriate services as well as basic nursing skills in the home. This training must extend to health professionals and others involved in caring in Governments, Missions and other services. Undergraduate teaching in medical and nursing schools is essential to commence as soon as possible. Local experts in parallel areas, e.g. lawyers in will making, local professionals and others in cultural and spiritual aspects as well as oncology and surgical professionals in the different aspects of treatments.

Knowledge and Willingness to Absorb and Practise the Hospice Ethos

The ethos coined at Hospice Africa Uganda, is really the basis of all medical care, but we have strayed far from it in health care in most countries in the world (Figure 4). As we have developed health care, more and more bureaucracy has crept into our services, and we have moved away from the elements that should guide us as ethical doctors with integrity.

Without the ethos, palliative care becomes just another specialty where the interest is more in the disease than this person with a life, a family who is part of a community and has contributed to this world. This approach is essential for holistic palliative care.

African Spirituality

Spirituality is very precious to the dying and a huge need in African palliative care. It is also a large part of the ethos. But our team members must be spiritual themselves. Even if not affiliated to a religion we need to understand human spirituality and be able to relate to it. Relationships with their God are more important when someone is dying than their religion, although they may need to go through religious and traditional rituals.

Nearly all Africans can tell you their commitment to the “modern” religions, Christianity and Islam being the dominant religions given in the national censuses. But it must be remembered that Africans have been spiritual long before these religions were introduced. Their beliefs about life, death and the role of ancestors in their lives today, is entrenched in most Africans. It is also reflected in the traditional beliefs about being human and part of the human race to act human or “Ubuntu” or “Obuntu”. Coming towards death, he or she will believe in the mercy of their God, while believing that there are certain rituals they may have to carry out to please the ancestors or to reconcile them with people living or dead, before they leave this world.

Cultural beliefs are different in every tribe and area and some of them affect the approach to the dying process and to the form of burial services. The way a person is buried is very important to the tribe and this caused huge problems during the recent Ebola crises in Western Africa where people were instructed how the bodies should be handled so that the infection would not spread from handling the corpse.
The Role of Religions

Throughout the world many palliative care services have developed from the religious beliefs of the founders. A study of the common denominators between the founder of Christianity, Judaism and Islam found that the common denominator from all was “Compassion” directed towards the suffering (Armstrong, 1994). Their mantra was “Always treat others as you would wish to be treated yourself”. Thus we find palliative care services commencing from Christian, Islamic, Hindu and Buddhist beliefs, and religious communities, throughout the world. Those who declare themselves attached to one religion will receive funding through their declared religious affiliation. But although most today will give their services to all, no matter what belief, political persuasion or class, their religious affiliation may give the impression that they are going to convert, or will turn away those of other faiths not prepared to convert. African Hospices must be free from the necessity to evangelise and make converts to their beliefs, because this is a special time of life when our role is to bring the patient to the God they have known throughout Life, not to offend or to make false promises of cure if they convert to the faith of the organisation or other evangelistic members of their team.

But our patients must be able to discuss their spiritual needs with their palliative care team member. No longer as health professionals can we say that this belongs to the priest. This is now as much our domain. Thus we need to reflect on our own spirituality and also what we would need spiritually as we approach our own death. Our patient may want their own spiritual leader, but often they are happy to pray with our team or with neighbourhood prayer groups. Some have had unfortunate experiences with Church leaders, and do not want to be near them, but still will have spiritual needs. We cannot impose and if they do not want to discuss or share, leave them as they wish while caring and praying for them. We also assure him/her that we are there for them throughout this illness and will never leave while he or she needs us.

Other Innovative Models of Hospice and Palliative Care in Africa

Most African countries have drawn lessons for the provision of hospice and palliative care services from Uganda and used these to adapt innovative models in their settings. Kenya and Malawi have for example implemented a model for the integration of hospice and palliative care in public, private and mission hospitals to increase access. Among the various models for service delivery in South Africa is that which has seen the integration of hospice and palliative care in prisons health services. The hospital-based hospice (hospice-in-hospital) model implemented by Bamalete Lutheran hospital (BLH) in Ramotswa, Botswana is allowing for the extension of hospice and palliative care services to patients at home and in the community, through the sharing of resources between the hospice and the hospital. This has made it a sustainable model. The Botswana Retired Nurses Society (BORNUS) has piloted a purely community home based care (CHBC) model for the provision of palliative care alone hospice model that is providing palliative care service through home-based care, in-patient services and day care. In Zambia, Livingstone General Hospital has adapted a model of service delivery that has ensured a strong relationship between St Joseph’s Hospice and the hospital and this has strengthened the referral system for palliative care patients. In Tanzania, the reconstitution of powdered morphine to oral liquid at the General Hospital has adapted a model of service delivery that has ensured a strong relationship between St Joseph’s Hospice and the hospital and this has strengthened the referral system for palliative care patients. In Tanzania, the reconstitution of powdered morphine to oral liquid at the General Hospital has adapted a model of service delivery that has ensured a strong relationship between St Joseph’s Hospice and the hospital and this has strengthened the referral system for palliative care patients. In Tanzania, the reconstitution of powdered morphine to oral liquid has been decentralized to consultant hospitals and more than 65 hospitals are using oral liquid morphine.

The Morphine Story and Innovations in Providing Oral Affordable Morphine

The first two palliative care services in Africa commenced in 1979 and 1980 in Zimbabwe and South Africa. These were the two highest economies in Africa at the time and could afford to import oral morphine and other expensive step 3 analgesics. This was followed by a gap of ten years, when palliative care did not move.
During these ten years, the present formula for oral affordable oral morphine was designed to meet the needs of Singaporeans by their new palliative care team working in the homes. This formula was brought to Nairobi Hospice in 1990 and Kenya commenced a service that could move throughout Africa, even within those countries with low economies. Inspired by the need to stop the terrible suffering of cancer patients witnessed in Nairobi, and in order to facilitate the moving of oral morphine throughout Africa, Hospice Africa was conceived in 1992 and the model for all Africa chosen and commenced in Uganda in 1993. Since then the movement has moved throughout Africa now making palliative care available in 20 countries and support care in 15 more (Figures 5 and 6). The African palliative care association (APCA) was conceived to expedite the movement in the continent in 2002. They took this up in 2005 and have been successful in supplementing the coordination and support to Africa countries (Merriman et al, 2010).
Estimating Palliative Care Needs in Africa Today

From our work in different African countries, dealing with the 95% who remain in the communities and do not reach a biopsy, necessary to get onto the cancer registry, we realise that the figures given from different sources vary widely and most are inaccurate (Table 1). Most are based on figures for cancer from cancer registries which themselves are the results of biopsies and often confined to a small area, usually around the capital, of the country. But the majority of patients we see cannot afford their fare to hospital, much less the cost of a biopsy.

Thus we have come up with a formula using guestimates, using figures estimated in the past, by the occupying countries working in with cancer.

This formula can be used to estimate a country needs, or a subunit of the country down to village and health centre levels. It is being used to teach initiators and has become referred to colloquially as the "Merriman Formula" (F1).

These calculations at least give us the number of cancer patients in need of PC, but do not include the many others in need suffering and dying from AIDS and non-communicable diseases. Using these formulas, based on the populations, the numbers of people with cancer or in need of palliative care are much higher than the figures given from other sources, but we think they are much more realistic. They also relate to cancer needs only.

Table 1: Examples of four African countries in 2015 showing the expected prevalence of cancer in need of palliative care in 2015, based on population

<table>
<thead>
<tr>
<th>HDI</th>
<th>Country</th>
<th>Population (millions)</th>
<th>%HIV</th>
<th>Prevalence in need for palliative care (cancer patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>Ghana</td>
<td>26</td>
<td>1.4</td>
<td>15,000</td>
</tr>
<tr>
<td>122</td>
<td>Nigeria</td>
<td>177</td>
<td>1.4</td>
<td>151,800</td>
</tr>
<tr>
<td>144</td>
<td>Uganda</td>
<td>36</td>
<td>1.4</td>
<td>114,400</td>
</tr>
<tr>
<td>141</td>
<td>Zambia</td>
<td>45</td>
<td>1.3</td>
<td>63,800</td>
</tr>
</tbody>
</table>

Uganda: the Model for Palliative Care in Africa?

Palliative care was introduced to Uganda in 1993 with the commencement of Hospice Africa Uganda. This was to be the model for Hospice Africa, commenced with a vision of Palliative care for all in Africa. It was important that palliative care in Africa should be African palliative care suitable to any culture or economy to make it realistic and sustainable. Transplanting palliative care from the developed world had been tried several times and failed. The founders were adamant that it should commence from a free standing Hospice and NGO, free of the bureaucracy and lack of hospitality found in most hospitals today. Thus with limited resources, the clinical service and education service commenced simultaneously, even reaching the undergraduate medical and nurses students as well as health professionals and all those involved in the holistic management of patients in hospitals and the communities. Facing the reality that the vision could not be achieved without education, thus expanding the provider of palliative care throughout Africa, education commenced with the clinical service in 1993. Today there is training for all Africa up to degree level from the institute which is a major component of the care. There are three sites for Hospice Africa Uganda (HAU) since 1998 and presently 80% of Districts have palliative care available.
Chapter 8 – African Palliative Care

Uganda: Palliative Care Today

- 90 out of 112 districts
- HAU has managed 27,182 patients
- HAU has taught 9,848 Ugandan and African health professionals
- HAU is caring for 1,944 patients and families

Figure 8: State of palliative care in Uganda today

Uganda was also found to be 35th out of 80 countries measured in the Quality of Death Index 2015 (Economist Intelligence Unit, 2015). In a way this is an accolade but our vision would have expected more countries to have caught up with Uganda by now.

Ethos for Palliative Care Services in Africa

This is best represented in diagrammatic form (Figure 4). Our mainstay is hospitality, where our patients and all who come to our service are welcomed, having choices in all decisions being made so that the patient and family come together. The three pillars of the ethos are based upon the patient and family being the centre of all we do and all our decisions, whether for administration, clinical or teaching. This pillar is supported by the second and third pillars, our caring for each other and recognising that none of us can reach all Africa alone. We need to work together with our partners who we respect and support. This includes working with the oncologists and all who are caring for patients in critical illness or approaching the end of life.

The ethos must be incorporated into every clinical service and into all teaching so that African hospitality becomes a model, not just for palliative care but for the return of health professionals to their caring philosophies more than curing. In a world where death is the only certainty, surely we as carers need to be able to help others to prepare for this even if we too need to be prepared for it?
The African Palliative Care Association (APCA)

The function of a palliative care association is to:

1. Coordinate with the Ministry of Health and civil society organisations all the services in the country, to ensure services are equally distributed throughout the country and supported through network.
2. Update all recent advances affecting their country at regular country meetings.
3. Support education services in the country by supporting teaching in all districts or political divisions.
4. Advocate for palliative care services with the government based on the public health needs of the people. To work with the Government, keeping them up to date with gaps and human resource needs; to ensure palliative care reaches all in need.
5. Ensure that medications are available particularly oral morphine.
6. Keep registers of:
   A. All services in the country so that health workers and patients can call them to find the nearest to them
   B. All registered morphine prescribers, except doctors who are registered with the Medical Council
7. To produce newsletters and publication so that all keep up to date on the services and to share innovations which can be applied for fund raising and services.

The establishment of national palliative care associations in 23 countries in Africa has also accelerated the development of hospice and palliative care services and well as its integration in main stream health services (Figure 9).

Palliative Care Development in Africa as Seen Through the WHO Health Systems Building Blocks

Palliative care needs to have proper leadership and governance within a national health system that ensures development and retention of good human resource force to effect the required palliative care service delivery. This requires a good health information system with palliative care indicators, good supply of palliative care medicines as part of the essential medicines list and good and sustainable financing.

The Need for Palliative Care in Africa is Difficult to Measure with Accuracy but Nonetheless Significant.

In 2004, the World Health Organization estimated that at least one in every 100 individuals each year in Africa needed palliative care. Because of the prevalence of cancers and Africa's HIV/AIDS epidemic, the WHO projects that at least 50% of patients with HIV and 80% of patients with cancer will experience severe pain during the terminal phase of their disease.

According to the UNAIDS, in 2013 an estimated 24.7 million people in sub-Saharan Africa were living with HIV and AIDS, while cancer rates on the continent are expected to grow four-fold over the next 50 years. More than 50% of Africans do not reach a health facility. Those who do reach a facility, over 80% of cancer cases are in advanced stages at the time of diagnosis because of late presentation to health facilities and poor access to diagnostic technology (Kanavos, 2006). Despite documented successes in cancer treatment and control programmes globally (Ngoma, 2006; Rustoe et al, 2004) large differences in mortality persist, with survival rates in developing countries often far less than half those of developed countries.

Also as people's lifestyle, nutritional preferences and non-sedentary work patterns on the continent are changing Africa is experiencing an increase in the incidence of chronic, life-limiting non-communicable diseases like diabetes, hypertension and strokes which all contribute to the burden of diseases coming to Palliative Care.

The Public Health Approach to Palliative Care in Africa

The public health approach to palliative care highlights that the provision of Palliative Care must be founded on knowledgeable caring teams, clinical care with adequate affordable medications from which appropriate government policies can be written. Implementation and integration of palliative care within the health systems is necessary, at all levels. Research is now recognised as a pillar of the WHO Public Health model, and the immense contribution of this field to patient care and education cannot be overemphasised (Figure 10).
Table 2: Minimum essential drugs required for pain and symptom control in Uganda and other African countries, 2012 (Merriman et al, 2012)

<table>
<thead>
<tr>
<th>Generic Drug</th>
<th>Proprietary</th>
<th>Dose</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amitriptyline</td>
<td>Lentizol</td>
<td>10, 25, 50 mg</td>
<td>tabs</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>Epanutin</td>
<td>100 mg</td>
<td>tabs/liq</td>
</tr>
<tr>
<td>Acetyl Salicylic Acid</td>
<td>Aspirin</td>
<td>300 mg</td>
<td>tabs</td>
</tr>
<tr>
<td>Diclofenac</td>
<td>Volterol</td>
<td>25, 50, 75, 100 mg</td>
<td>tabs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75 mg/3mL</td>
<td>inj</td>
</tr>
<tr>
<td>Codeine</td>
<td></td>
<td>30 mg</td>
<td>inj</td>
</tr>
<tr>
<td>Morphine</td>
<td></td>
<td>5 mg &amp; 50 mg/5mL</td>
<td>liq</td>
</tr>
<tr>
<td>Chlorpromazine</td>
<td>Largactil</td>
<td>10, 25 mg</td>
<td>inj &amp; tab</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>Serenate</td>
<td>5 mg</td>
<td>tab</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>Decadron</td>
<td>0.5, 2 mg</td>
<td>tab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 mg/mL</td>
<td>inj</td>
</tr>
<tr>
<td>Diazepam</td>
<td>Valium</td>
<td>2.5, 10 mg</td>
<td>inj &amp; tab</td>
</tr>
<tr>
<td>Frusemide</td>
<td>Lasix</td>
<td>20, 40 mg</td>
<td>inj &amp; tab</td>
</tr>
<tr>
<td>Spironolactone</td>
<td>Aldactone</td>
<td>50, 100 mg</td>
<td>tab</td>
</tr>
<tr>
<td>Ketoconazole</td>
<td>Nizoral</td>
<td>200 mg</td>
<td>tab</td>
</tr>
<tr>
<td>Nystatin</td>
<td></td>
<td>100 &amp; 500,000 iu</td>
<td>Tab/susp</td>
</tr>
<tr>
<td>Magnesium Trisilicate</td>
<td></td>
<td></td>
<td>liq</td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>Placil</td>
<td>10 mg</td>
<td>inj &amp; tab</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>Flagyl</td>
<td>200 mg</td>
<td>tab</td>
</tr>
<tr>
<td>Amoxycillin</td>
<td></td>
<td>250 mg</td>
<td>cap</td>
</tr>
<tr>
<td>Bisocodyl</td>
<td>Dulcolax</td>
<td>5 mg</td>
<td>tab</td>
</tr>
<tr>
<td>Hyoscine Butylbromide</td>
<td>Buscopan</td>
<td>10 mg</td>
<td>inj &amp; tab</td>
</tr>
<tr>
<td>Chlorpheniramine</td>
<td>Piriton</td>
<td>4 mg</td>
<td>tab</td>
</tr>
</tbody>
</table>

In developing countries often gifts are given of medications at low or no cost from charities. Some of these are similar to the above and can be used. Some are different and if commenced cannot be continued. Medics not wanting to use morphine may use alternative, but not affordable step 3 analgesics but they must be aware that if the patient lives longer than the supply, the patients will be thrown back into severe pain.

In Africa it is important to remember that care of the patients must not be put on hold while awaiting a government policy and the components of the WHO public health model (policy, education, medication availability, etc.) must be put in place with the needs of the patient and family in mind and always at the centre.

Also while the International Association for Hospice and Palliative Care (IAPHC) and the WHO have developed lists of essential medicines for palliative care, the entire armoury of medications which are available in the developed world is not available for most African countries and it is crucial that the most affordable medications for palliative care are selected from a country's essential list of medications.

Experience shows that initially, most countries are missing the essential medications for pain control. Palliative care for cancer, cannot be established without pain control being in place (Table 2).

Challenges in the Assessment and Management of Pain in Africa

Modern palliative care has spread across Western Europe, North America and Australia, where it is widely integrated into the health system, so it is difficult to imagine that in many African countries palliative care is not integrated into the health system and in many countries medicine for the management of severe pain is absent.

As is the case everywhere a comprehensive clinical assessment is fundamental to successful treatment. In Africa many people are unable to read and write and the comprehension of scales and tools, like the Wong-Baker scales, is sometimes a challenge. This is complicated by the fact that standard pain scales are often developed and validated in non-African settings. It is therefore necessary to develop reliable, culturally-appropriate tools.
pain assessment tools and several are in development and validation in African populations. An example is one based on African cultural familiarity with the jerrycan used to collect water as most homes are not plumbed.

Pain scores on the jerrycan pain scale (JPS) have been found to be well-correlated to standard pain scales (Numerical Hand Scale and the Wong-Baker faces pain scale) and many patients have preferred to use the JPS. The jerrycan pain scale is a culturally appropriate, reliable way to assess pain in the Ugandan population and is being used at Hospice Africa Uganda.

### Table 3. The jerrycan pain scale

<table>
<thead>
<tr>
<th>Jerrycan Level</th>
<th>Jerrycan Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty</td>
<td>Very light to carry</td>
</tr>
<tr>
<td>Nearly full</td>
<td>Extremely light to carry</td>
</tr>
<tr>
<td>Over half full</td>
<td>Heavy</td>
</tr>
<tr>
<td>Full</td>
<td>Very heavy</td>
</tr>
</tbody>
</table>

Eighty-six percent of the world’s morphine is still used by the 20 richest countries (Spencer, 2003), and according to the International Narcotics Control Board (INCB) South Africa is the highest user of morphine and other licit opioids on the African continent and the only African country whose consumption is above the global per capita mean. The other countries which are increasing their morphine consumption are: Uganda, Malawi, Kenya and Cameroon.

### Analgesic Ladder

<table>
<thead>
<tr>
<th>Pain Level</th>
<th>Analgesic Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Paracetamol, ±Adjuvants</td>
</tr>
<tr>
<td>Moderate</td>
<td>Codeine, ± step 1 and/or ± Adjuvants</td>
</tr>
<tr>
<td>Severe</td>
<td>Morphine, ± step 1 and/or ± Adjuvants</td>
</tr>
</tbody>
</table>

Note: More recently codeine, which has a ceiling and is more expensive than oral morphine, has been skipped and patients move from step 1 to step 3 without step 2. In countries without morphine, codeine may be the nearest alternative. If codeine is used we do not add in morphine as they use the same receptors.

According to the WHO, pain relief requires the analgesic ladder first described in their booklet “Cancer Pain Relief” in 1986. Severe pain requires step 3 analgesics and the only affordable one in most African countries is morphine. As most wish to die at home and most do die at home, this has to be an oral form so that the patient and family, fully informed, can administer it using the usual precautions. It must be remembered that oral morphine has never been known to cause addiction. Morphine needs to be given in high concentrations intravenously to give any form of a high and pain is a physiological antagonist to pain. The side effect of dryness after the patient is stabilised indicates the dose is too high. The patient should be free of pain and able to concentrate on other pertinent and immediate aspects of leaving life, once he/she is controlled and without pain. The main side effect is constipation and this is managed with simple laxatives or if not affordable, dried and smashed pawpaw seeds given at night also keep the patient comfortable with normal bowel movements.

Besides the lack of availability pain relief in many countries in Africa is hindered by barriers to the accessibility of opioid analgesics. Overzealous drug control by policy makers, and laws and regulations crafted to restrict the diversion of medicinal opioids into illicit markets, interfere with the availability of morphine for the relief of pain. This is compounded by myths and fears which abound among many of the older clinicians though with sensitisation and education this is steadily changing.

In total, 15 African countries have adopted the morphine reconstitution formula, and five other countries have access to some type of oral morphine by end of 2015. Access is especially poor among the Francophone and North African countries. Africa therefore has a difference in outcomes between high-income and lower-income countries for oncology services called the great “cancer divide” (Knaul et al, 2011) in addition there is the disparity in access to pain medication and schism in level of Palliative Care integration - which we can call the “Palliative Care divide”.

### Other Pains, Other Treatments

It must be remembered that it is important to diagnose the cause of the pain by taking a thorough history of start, the character, severity and frequency of the pain. Neuropathic pain responds more to antidepressants and/or antiepileptic’s and bone pain more to step 1 analgesics. But both can be improved by the addition of small doses of oral morphine.

Using the affordable medications, it is possible with experience, to manage 90% of pain in cancer patients without injections. Even when the patients cannot swallow, oral morphine can be absorbed from the buccal mucosa. Hospice Africa Uganda has not used injections or pumps for 20 years. Adjuvant medications also include the use of corticosteroids. The medications affordable, available and suitable for Africa, are discussed in detail in the Blue Book.

### Morphine

**Why Oral Liquid Morphine?**

In Africa most patients have severe pain at time of presenting to the clinician. When available most are given a stat dose of 5mg of oral morphine because it is difficult to give history and be examined if one is in severe pain (Figure 11). It also helps develop trust and confidence in the palliative care service. It must be remembered that it is important to diagnose the cause of the pain by taking a thorough history of start, the character, severity and frequency of the pain. Neuropathic pain responds more to antidepressants and/or antiepileptic’s and bone pain more to step 1 analgesics. But both can be improved by the addition of small doses of oral morphine.

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practitioner, as many patients have been in pain for a long time. Most of the patients in severe pain have probably already been on simpler analgesics like NSAIDs, and it is often easier to move straight to oral morphine.

For continuous management of severe pain the home with therapy controlled by the patient there is no better option than oral Morphine. It is highly effective for severe pain, is inexpensive (see table below) and has no ceiling, so the dose can be increased to keep the pain controlled. It is also easier to titrate the correct dose with the flexibility of doses from a solution and breakthrough doses can be given. The oral route does not require expert/nurse availability for its administration, and the entero-hepatic metabolism and modification of the medication without giving a “high” mean that unlike parenterally administered opioids there is very little propensity for abuse of oral liquid morphine.

Formula for reconstitution: Simple/ kitchen sink & modern pharmaceutical plant

Because oral liquid morphine is so inexpensive to make up from ingredients and does not require high-tech equipment it can be reconstituted by any service “in a kitchen sink”.

The most commonly used formulation of oral liquid morphine is the 5mg in 5mL strength. The simple formula requires 4 ingredients:

1. Morphine sulphate powder 80g
2. Bronopol powder BP 16g - This preservative gives the product a longer shelf life of six months compared with parabene which gives three months.
3. Green colour powder (Tartrazine) 4.8 g
4. Purified water 80L

Colour Coding of Morphine Solutions

This is a safety measure. Clear fluid can be misinterpreted for water and large amounts swallowed. In Africa many sick patients cross borders to receive treatments for cancers and other painful conditions not available in their own country (Table 4).

<table>
<thead>
<tr>
<th>Strength</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mg / 5 mL</td>
<td>GREEN</td>
</tr>
<tr>
<td>50 mg / 5 mL</td>
<td>PINK/RED</td>
</tr>
<tr>
<td>100 mg / 5 mL</td>
<td>BLUE</td>
</tr>
</tbody>
</table>

Comparative Cost of Morphine

In Africa many patients are commenced and are on much lower doses of opioids than patients in developed countries. It is possible that there is a genetic basis for this difference. Most adult patients who are not emaciated are on an average of 5 to 7.5mg of morphine every 4 hours and a 500mL bottle of morphine of strength 5mg in 5mL lasts about ten days, including breakthrough doses. The cost of this bottle made up using the simple formula above in Uganda is £8.19 (1.66 UK pounds or 2.36 USD). A 500mL bottle of Oramorph morphine sulphate 10mg/5mL solution costs £8.50 UK pounds. For the same amount of analgesia the oral morphine solution made in Uganda costs less than one third of Oramorph and is probably the cheapest opioid preparation in the world! The combination of being inexpensive and the fact that it can be made up low-tech is the reason why the Ugandan government is able to ring-fence funds for pain relief for all its citizens in need. Several African countries are now using the simple formula to reconstitute oral morphine solutions from powder for their patients and this has been shown to be a sustainable way towards pain relief for all.

Myths and Fears Around Morphine in Africa

Some people and communities in Africa have superstitious beliefs and these sometimes impact on the administration of care and the use of medications including morphine. “Opiophobia” which is the unbounded fear of opioids including morphine is real and is not restricted to lay persons but is also there among health professionals who have not received training in Palliative care and for whom education in the medical and nursing school emphasised the toxicities of morphine rather than its rational use for management of severe pain by trained professionals.
The main myths and fears around morphine are:

- Respiratory depression— which is unknown in our experience when using small doses of oral morphine titrated against pain. Pain is a physiologic antagonist to respiratory depression.
- Tolerance: Increasing dosage of morphine is the accepted method of titrating morphine against the pain until the patient is controlled. The only upper limit is the dose that controls the pain while the patient is still alert.
- Addiction - Addicts are looking for a “high”, which cannot be obtained when morphine is taken by mouth. This is only obtained with stronger concentrations given intravenously.
- Cognitive impairment: there may be some sedation when morphine is first commenced, but this is temporary, lasting two three days at the most.
- Lethality: Morphine does not kill when properly prescribed and gradually increased according to need. As many Palliative Care patients in severe pain will be taking morphine when they die some family members mistakenly ascribe the death to morphine rather than to the patient’s advanced disease.

### Table 5: Barriers to morphine importation and use in African countries

<table>
<thead>
<tr>
<th>BARRIER</th>
<th>REASONS</th>
<th>SOLUTION</th>
</tr>
</thead>
</table>
| 1 | Overly strict laws governing use of narcotics — Excessive regulation of addiction — Laxing per knowledge about morphine | Too much bureaucracy and in country regulations | Education, Sensitization, Advocacy — Perinatal and Tertiary care education
| 2 | Morphine not reaching outlying areas in country — Low pharmacy for pain management in health care systems | Problems of transportation and distribution of opioids to remove social evils — Shortage of prescribers, pharmacist and dispensers e.g. per 100k (District Population size) | Facilitating distribution to remote rural areas — Expanding the prescriber pool of opioids (NATIONAL) — Encouraging use of affordable and effective use-rate (WHO/WHO) strategies |
| 3 | Inadequate knowledge about morphine | Onsite trials where patients can observe active medical care in pain control — They advise Governments and patients |
| 4 | Government and the private sector are not involved in pain management and not willing to learn | Each country wants to make its own regulations and not willing to learn | Health Sector: Learning from the experience of ACPA/ HAU and other initiatives |
| 5 | Morphine produced at non user friendly strengths — Recommended changes already incorporated in the WHO guidelines | Methadone is cruel and inhumane | User friendly Recommended strengths and colouring — Green: 5mgs /5mls — Pink: 15mgs/5mls — Blue: 100mgs/5mls |

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- Example 1: One country has taken the ampoules and made it up into oral solutions of the recommended strengths. As there is already a preservative in the injection, there are only three ingredients required, leaving out the Bronopol. But this is labour intensive as the morphine in each ampoule has to be withdrawn and placed into a receptacle to add water and colour.
- Example 2: another country is giving an ampoule to the patients and asking them to add the required dose, having withdrawn it into a syringe, puts it onto a sugar or a food like yogurt and swallows it.
- Example 3: BE WARNED: Some well wishers in the developed world have brought in tablets or other oral preparations of morphine into an African country and given them to palliative care teams. This is dangerous! It is a criminal offence to carry class A medications unless prescribed for the person carrying it. This practise could have a huge effect on the legal importation to all African countries. This also throws the patient back into pain when the limited supply finishes.

The Pain-Free Hospital Initiative

This is an initiative commenced with the help of the American Cancer Society through their programme “Treat the pain” (American Cancer Society, 2016) in 2014. The American Cancer Society has partnered with government health agencies in Nigeria, Uganda, Kenya, and Ethiopia to assist them in improving access to high-quality pain relief as part of the Treat the Pain programme.

This programme augments the efforts of HAU and APCA by initially focusing on getting morphine into a country and making it affordable for patients. All the above countries already had morphine through the efforts within Africa. Treat the Pain have taken on the initiative commenced within Uganda and carried it forward. They have now introduced in each of the above countries, a training programme in five hospitals, which focuses on pain control and ensures that oral morphine is available.

They have developed a very helpful “Morphine Framework” which can be accessed from their website, indicating the steps to pain free countries, from Government advocacy to hospital level. The next step is to reach the communities where most of those in pain are suffering. Organisations and countries need to work together in a harmonised fashion to make this a reality.

Up to now they are not involved with patients after discharge but these hospitals are encouraged to be involved with a home care service or if not available, to commence one themselves.

### Policy and Legal Frameworks

Worldwide adequate relief of cancer pain is now considered to be a human right. Policy and legal frameworks to remove unnecessary suffering and to promote cheap and effective palliative care is seen as both a public health and a human right issue.

In most African countries, palliative care services have started before the development of national palliative care policies. Delaying the start of palliative care service provision until completion of national policy frameworks for palliative care causes delays and untold suffering for patients. Most African countries, successful in palliative care so far, have used existing international conventions and frameworks to avail opioids and palliative care as they waited for the complete adoption of national palliative care policies. This has helped to develop home grown best practices.
and service delivery models that have in turn informed national palliative care policy development. Countries that have waited for palliative care policy development before starting palliative care services have experienced time lag in service development. On the contrary, the countries that started palliative care service provision as they worked on policy have had the opportunity to pilot practices and approaches that have in the end augmented policy development.

Uganda is the first African country to practice using the WHO guidelines developed from such services, and prioritised palliative care as an Essential Clinical Services in its National Health Plan of 2001–2005. Previously in 1998, after years of lobbying, the Ministry of Health invited Hospice team members to be technical experts in a pilot study in 15 (out of 56) districts to assess the feasibility and safety of using morphine for chronic pain in the community. In 2002–3, the districts, including mission hospitals, undertook extensive initial training involving local docrinies, police, and senior health officials. Uganda has passed laws to allow nurses and clinical officers with training in palliative care to prescribe oral morphine (Ministry of Health, 2001), an essential step as at a ratio of 1:20,000 doctors are scarce in rural areas. Palliative care is included in the mission of the Ministry of Health, the National Health Policy, and the Health Sector Strategic and Implementation Plans.

National Cancer Control Plans and Palliative Care

It is now recommended that palliative care should be part of the continuum of cancer approaches starting with promotion of life styles that prevent cancer, using cancer prevention approaches such vaccination, early detection and treatment of cancer as well as rehabilitation and palliative care.

Service Delivery and Models

Most PC services in this world have commenced from one person, usually inspired by their compassion, inspired by the founder of their religion based on their love of their God. Hence many have been developed from religious groups of different persuasions. Dame Cicely herself, having grown as an agnostic, was a deeply committed Christian when she conceived the idea of St Christopher’s and pain free care for the dying (Clark, 2005). It was in 1948, as an almoner, that her patient David Tasma told her before he died “I will be a window in your home” (for the dying) and left her £500 in his will for this window which still inspires many visitors to St Christopher’s today. His other words “I want what is in your mind and in your heart” reflect how different palliative care is to other specialties in medicine. As Balfour Mount says in his forward to the same book, “Compassion cannot be tabulated in columns, nor are we yet able to assign a p value to the significance of diminished suffering”. Care of the spirituality of the patients, families and team members in palliative care was a priority for Dame Cicely from the start. This is more than relevant in Africa today.

Dame Cicely researched the use of oral morphine in pain control from St Joseph’s Hospice in Hackney, after graduating as a doctor in 1957 and St Christopher’s opened in 1967. Cicely recognise that holistic care of “total pain” was impossible without the control of the severe pain of cancer. In Africa, where the chance of cure is minimal, it is even more important that pain control is affordable and available to all even to those who cannot reach a hospital, in the home.

Sadly, pain control is often the last thing sought by those caring in hospitals, even though it is often the biggest problem for the patient and the family. Yet, Human Rights Watch considers doctors who neglect pain control, when methods have been known for more than 50 years, should be considered as torturers! Pain control can be commenced immediately even before the diagnosis has been confirmed and curative therapy commenced.

Service Delivery Models

Development of palliative care service delivery models needs to be directed by patient needs. Each country is different. Thus situation analyses, political will and direction and emerging evidence from research and audits have contributed, but the heart comes from relationships and experiences with our patients.

Over the years several service delivery models have been developed in Africa and below are experience to date, using case studies:

A Model of Public Private Partnership for Oral Morphone Procurement, Reconstitution and Distribution in Uganda

Public Private Partnerships (PPP) are moving in health systems today. The recognition that the voluntary sector has the knowledge and expertise and the Governments through their Ministry or Health have the funding, brought this about. This partnership worked well, particularly in palliative care.

While Hospice Africa Uganda (1993) was the fourth Hospice in Africa it was the first with a vision for all of Africa. It commenced from the need to address the extreme suffering witnessed in cancer. A year after commencement the suffering of AIDS patients was addressed, due to a high prevalence of HIV in Uganda at the time and the lack of knowledge of pain control in the AIDS support organisations. Hospice Africa was encouraged to come to Uganda, supported by the commitment of the Ministry of Health, for the relief of the suffering among its citizens. Hospice Africa Uganda (HAU) imported the first kilogram of morphine powder in 1993. This was reconstituted into a solution together with a preservative and cake dye used to differentiate strengths. The solutions were put into recycled mineral water bottles. This simple formula of making liquid morphine at the “kitchen sink” produced an affordable form of oral morphine which was appropriate for use in the patients’ home.

Since 2011 HAU entered a public-private partnership with the Ministry of Health/Government of Uganda to scale-up morphine production for all the country. HAU has the expertise and with ringfenced finance from the government, affordable pain relief is available for all citizens who need relief from severe pain. This model entailed the setting up of a more sophisticated production facility. In 2015 the unit was further modernised so that a local morphine reconstitution facility is now in place at Hospice Africa Uganda. The PPP is the joining of an NGO hospice with the Uganda government, which provides the funding.

After the reconstitution, the liquid morphine is sent to the National Medical Stores (NMS) a national medicines procurement and distribution parastatal company. The NMS then distributes to all government facilities at no cost to the patient. The morphine is also distributed to the non-government and faith-based hospitals through the Joint Medical Stores an entity owned by the Uganda Catholic and Protestant Medical Bureaus, to serve their constituent health units across the country.

Some countries have commenced with a free standing Hospice based on the experiences of hospice Africa Uganda. However, with the problems of funding, many have commenced within hospitals so that some of their care can be supported financially by the health system of the country. But this has its drawbacks, particularly due to the bureaucracy which controls our care of patients more than the patients’ needs controlling what we do.

Public private partnerships have been tried in different settings but has its drawbacks, particular due to the bureaucracy which controls our care of patients more than the patients’ needs controlling what we do. The choices made are sometimes informed by the experience of those countries that have been able to develop hospice care in a country with a stable health system. This experience is not common in Africa.
Models of Hospices or Palliative Care Units Within a Hospital

A large number of patients are admitted to hospitals for uncontrolled pain and symptoms from HIV/AIDS, cancers and other illnesses. The need for hospital palliative care is therefore well recognized. Palliative Care needs are more profound among oncology patients and it is imperative that palliation is available to patients in addition to specialised oncologic treatments. Few hospitals however have the ethos for palliative care and this is often strangled by the bureaucratic demands on health workers to hit targets more than meet their patient’s needs.

Sadly, most palliative care units do not have dedicated beds, so patients are admitted to other wards and often not referred to the PC team. Dedicated beds would ensure that patients were screened in palliative care, before being transferred to other units for specialised treatments.

A model of palliative care in a public hospital helps to ensure integration of palliative care services within the hospital. The hospital may be in a public hospital as is the case in many of the hospitals in Kenya where the Kenya Hospice Palliative Care Association (KHPCA) works with public hospitals to establish these units in government facilities. It could also be in a mission or church hospital as is the case of Ramotswa Hospice in Botswana. Other examples include Malawi, Tanzania, Mulago Teaching Hospital in Uganda and Livingston General Hospital in Zambia.

Such models can help avoid duplication of services and ensures smooth and timely referrals for palliative care as well as utilisation of hospital doctors to support opioid prescription which would have been difficult with hospices that cannot hire full time doctors. But to give patients smooth relief throughout the illness they all need to have their own palliative care team in the community or have another service to refer patients to as discharge as they will deteriorate and be unable to attend hospital out patients departments.

In Uganda the national referral hospital at Mulago has a Palliative Care unit based within the Department of Internal Medicine through which specialist physicians and nurses offer support and consultative services to the entire hospital complex through a system of “link nurses” who are from the different wards and specialties. The link nurses are trained at a generalist level and are able to manage basic palliative care needs of their own patients and through a liaison service have access to specialists to manage the most complex palliative care needs.

Stand-Alone Hospices

As most of those in dire need of palliative care are unknown to health services and in the communities, the vast majority of hospice care in Africa consists of non-governmental and faith-based organizations. This model consists of an independent hospice and in most cases, not-for-profit, set up to provide palliative care to the community in a defined geographical area with links to other health care units within that geographical area for two-way referral.

The simplest does do have in-patient facilities, giving consultations within hospitals and caring for patients and families in their own homes. Some have come with the Western model based on inpatient beds, and most have failed because of expense. However some that have home care models have more recently added a few beds for emergencies only, more for social than medical emergencies.

Free-standing Hospices are a good model for the promotion of the ethos and spirit of Palliative care in Africa. They are able to raise their own finances, craft their strategic plans and supplement government health systems. Being autonomous they fit an important void, for home-based care within catchment boundaries, which is rather expensive for many countries’ health systems. These are key to palliative care in Africa where the majority of cancer patients remain in the community with extreme suffering. Valuable partnerships between Hospices and hospitals create a system for continuity of care for patients. Many stand-alone Hospices maintain high palliative care standards and become centres of excellences in their regions/ countries.

Such examples include the Island Hospice in Zimbabwe, Holy Cross Hospice in Botswana, Nk’Myo in Salima, Malawi and Hospice Africa Uganda among others.

Service Delivery Organisations

Many studies have emphasized the importance of the home as part of the African identity. Studies in Uganda and five other Africa countries (Kikule, 2003; Sepulveda et al, 2003) have shown that most patients and their own family members prefer home, when support services are available, to hospitals for their end of life phase. Here they are close to their relatives and ancestors, and in an environment which is familiar to them. Many service delivery organisations therefore also offer out-patient services, with day care services and outreach clinics into the communities. This also is sustainable in a resource-limited setting as in-patient care is very expensive. Community based services appropriately utilise the social fabric of large and extended families which are common in many African countries.

The service may be organised around a non-residential hospice, with teams that offer services to patients in the homes in the community or in the local hospitals, as is the case with Hospice Africa Uganda and Island Hospice in Zimbabwe. This may also be offered by an inpatient hospice as found in Pabalelong Hospice in Botswana and several others in South Africa.

Access to opioids has developed in Africa progressively through inclusion of palliative care medicines and opioids in the national essential medicines lists. This has happened in several countries including Uganda, South Africa, Rwanda, Botswana, Malawi, Kenya and Zambia. According to the 2015 Quality of Death Index, Uganda has made huge advances in availability of opioids.

The use of mobile phones to monitor morphine stocks has been piloted in Uganda and is an area of potential development. Health services including the use of mobile phone technology to monitor medicines access and procurement, as well as reporting, is therefore an area that many countries can explore.

Local and national reconstitution of powder morphine into liquid morphine takes place in Kenya, Tanzania, Malawi, Ethiopia, Nigeria, Cameroon, Swaziland, Rwanda, and several others are still working with their Governments, with the help of Hospice Africa and APCA, to ensure the importation of powdered morphine.

Human Resources Management and Education

Human Resources

Palliative care is a specialty, but also a special calling or vocation. Supporting others at the end of life is not easy and often requires a higher commitment based on the compassionate and spiritual nature of the candidate. This cannot be assessed from applicants to institutes or centres but should be assessed by employers and those deciding on who to send for palliative care training. Training is essential for all PC teams.

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The following are the programmes that have developed within Africa since early 1990:

**Teams, but there are not enough trained to meet the needs of the millions in need.**

The palliative care teams were initially small and widely dispersed but as PC training improves and expands, more units are able to have trained team members as well as untrained members, who are trained on the job. Those who exceed will be sent for further education. The team spirit is held together by the ethos.

Palliative care and oncology need to be more closely associated within education programmes. Thus all palliative care programmes should have oncology sessions or modules and all oncology palliative care sessions or modules.

But all this takes money. Rarely can Africans find the funding for a long programme so scholarships from donors have supported most to date.

With the funding going down due to the donors being hit recently by the recession, it is becoming more difficult to obtain funding. The palliative care teams were initially small and widely dispersed but as PC training improves and expands, more units are able to have trained team members as well as untrained members, who are trained on the job. Those who exceed will be sent for further education. The team spirit is held together by the ethos.

The palliative care programmes were initially small and widely dispersed but as PC training improves and expands, more units are able to have trained teams, but there are not enough trained to meet the needs of the millions in need.

The following are the programmes that have developed within Africa since early 1990:

- Short courses up to a week are really sensitisation and not training but they are essential to get the approach out there. These short courses are available in many countries. These include courses held for the teams as well as different cadres such as health professionals, allied health professionals, community volunteers and carers in the home, traditional healers where most patients have attended before presenting, spiritual advisors, counselling for counsellors on end of life care etc.

- Intermediate courses are held for special cadres e.g. clinical officers in PC and prescribing, tutors, teachers in health institutions, training of trainers, and so on. These last between five and nine weeks. Many who attend these programmes will not be working full time in palliative care but need palliative care knowledge and skills to be incorporated into their every day work and to know and how to refer.

- International Initiators programmes are a minimum of five weeks. These are for health workers who have just commenced or about to commence a new service. They include sharing with other countries as well as learning the basics of African palliative care, clinical care in hospital and the home and finally, TOT so they can return to their own countries and train others. Presently these are from International Programmes of HAU and are held mainly in Uganda but have also been held in Nigeria and Malawi, after assessment of services and on request. The clinical component of this training is essential to be of highest quality. Thus it is essential that countries requesting this programme are first assessed for high quality palliative care service and enough training sites for the students to receive experience in different settings.

- Training of Undergraduate health workers in medicine, nursing and other health professions take place in Universities and institutes of Higher education. These are most important because on this training depends the knowledge for the future of medical services in which palliative care will be incorporated. Also as more and more doctors are trained as undergraduates, the more influence they have as advocates on Governments to ensure the medications and services as well as policies are carried through. However as palliative care in this world, and particularly in Africa, is mainly based on the caring nurse, undergraduate and post graduate training of nurses is possibly the greatest need.

- Intermediate Degrees and Diplomas are held in Institutes of Higher Education, and presently held in Cape Town University, South Africa in conjunction with Cardiff University, United Kingdom and HPCDA/Makere at Hospice Africa Uganda. Diplomas are also available in Nairobi Hospice with Oxford Brookes University, and Mildmay in Uganda. Institutes of Higher Learning in other countries are in the planning stages.

Many countries are finding it difficult to employ the palliative care trained personnel. Thus we find that some who are trained are then placed in areas not requiring palliative care but to fill places in the health systems. This means that they are de-skilled and their higher degrees are a waste of time and money, and only used to boost their CVs. It is important that those trained are placed in positions to match their skills.

Like all education, training should be matched to the positions available after training. This is particularly important for expensive degree and diploma programmes. After completing training it is important that the candidate serves in a palliative care post for at least two years so as to internalise and practise the ethos and the specialty.

There should be at least one specialist nurse in palliative care attached to each oncology and/or radiotherapy unit in each country. This multi-purpose Nurse can ensure continuing medical education (CME) for the teams so that no patient is left in pain or without holistic care in critical situations.

Informal education programmes were commenced in South Africa and Zimbabwe early on. Hospice Africa Uganda commenced the service alongside clinical teaching and advocacy in 1993 and this has progressed since to a degree awarding Institution with degrees and Diplomas available for all in Africa. Education has been well established alongside clinical services in Zimbabwe, South Africa, Kenya and Uganda since they were founded. Uganda was the first to introduce palliative care in the undergraduate curriculum for doctors in 1994 and this became examinable in 1996. Training undergraduate nurses was done in parallel, while training of those working in the community including volunteers, carers in the home, traditional healers, spiritual advisors and para-medicals including lawyers and teachers, as well as short courses for health professionals in practice, were also introduced. Education alongside an impeccable clinical service was seen as the most effective way to follow the vision of ‘palliative care for all in Africa’.

In August 2004 Uganda introduced statutory instrument 24 which authorises appropriately trained nurses and clinical officers/ medical assistants to prescribe certain forms and strengths of morphine without requiring the signature of a medical doctor. This has made it possible to improve palliative care access in the country as stated in both the Quality of Death Index Report (2015) and the Global Atlas on Palliative Care (Worldwide Palliative Care Alliance, 2014).

Palliative care has also been integrated into health worker training at pre-service levels in Uganda, South Africa, Kenya, Botswana, Ghana and development of the specialist palliative care courses at diploma and degree levels has been achieved in South Africa. Kenya and Uganda while Malawi is in the process of developing its own local courses.

The following countries have developed palliative care education at different levels: South Africa, Uganda and Kenya have Degrees and Diplomas as well as shorter courses. Nigeria has short courses in several geopolitical zones, mainly from Universities, but few services and training reaching out to communities.
Health Information and Health Management Information System (HMIS)

The development of palliative care indicators and integration of these into national health information systems is also progressively taking off. Uganda has included two palliative care indicators in the national HMIS and these are the morphine consumption data and the number of patients requiring palliative care.

Finance for Palliative Care

The biggest challenge facing palliative care provision in Africa is funding. Palliative care in Africa has historically been funded by donors. These include trusts and foundations such as the Diana Princess of Wales Memorial Fund, the True Colours Trust, the Open Society Foundation (OSF) through the International Palliative Care Initiative (IPCICI), the Open Society Institute of Eastern Africa (OSIEA) and Open Society Institute of Southern Africa (OSISA), the American Cancer Society, Livestrong Foundation, Global Partners in Care and the World Prevention Alliance (African Palliative Care Association Annual Report 2013/14).

The western governments have also funded palliative care and the United States Government through the President's Emergency Plan for AIDS Relief in Africa (PEPFAR) gave palliative care development a very significant financial boost since 2004 this has come to an end. Other western governments and their agencies have included the Department for International Development (DFID) of United Kingdom, the Danish International Development Agency (DANIDA) of Denmark and some European Union funding.

With the dwindling of some of these western government funds, the burden of palliative care funding is carried by the trusts and foundations as well as some of the African governments that are starting to invest some money into the discipline. The governments of Botswana, Namibia, South Africa and Malawi are covering the costs of the medications as well as Uganda which has ring-fenced the money for oral morphine so that patients whether in government or NGO facilities get it free of charge.

More needs to be done to safeguard the lives of Africans and reduce unnecessary suffering especially when faced with life threatening illnesses such as cancer, Multi-resistant drug tuberculosis, HIV and others and especially at the end of life.

Sustainability

The cost of health care is high but Palliative care in Africa presents even bigger challenges because health insurance is rare, families are often impoverished by their illness, and in many cases a breadwinner is the unfortunate victim of a life-limiting illness needing Palliative Care. Few insurance companies include Palliative care as a benefit in their packages and when pre-existing chronic illnesses are discovered by underwriters many doctors due to the negative messages instilled into them as medical students re the dangers of addiction to morphine and the need to avoid it at all costs. This teaching had been changed in most medical schools in the world as the recent advances regarding this were published to many doctors.

Governance

A proper governance framework is critical for sustainable palliative care development. At the global level the World Health Assembly at its 67th sitting adopted a unanimously agreed palliative care resolution 67.9 that commits WHO member states to follow through with the nine roles that embrace palliative care integration into health systems, palliative care policy development, access to pain medications including narcotic medicines, palliative care education and research, partnerships and funding at country level. This resolution envisages the implementation and provision of palliative care through the life course. At the global level therefore countries have a guiding framework.

In Africa a number of governments have either passed or are in the process of developing national palliative care policies and frameworks. As at December 2015, national overarching palliative care policy development and adoption has been successfully done in Swaziland, Rwanda, Tanzania, Malawi, Mozambique, and Zimbabwe. Uganda and Botswana have also developed their draft policies and are awaiting final approvals and adoption at the highest level in government.

Inclusion of palliative care in National Cancer Control Plans has been done in Kenya and Zimbabwe. In Uganda, Botswana and Swaziland palliative care is included in the national Health Sector Strategic Plan as well as in the NCDs and HIV strategic plans.

Country Palliative Care Teams or task forces hosted by the ministries of health have been established in Uganda, Zimbabwe, Tanzania, Botswana, Namibia, Kenya, Swaziland and Mozambique.

The Ministries of Health in Swaziland, Botswana, Namibia, South Africa, Uganda, Kenya, and Rwanda as part of strengthening palliative care governance at the ministry of health level have established national palliative care desks to coordinate the palliative care initiatives in their countries.

Crosscutting issues

The role of Governments and doctors in availability of oral morphine

“States must recognize they have an obligation under international law to ensure access to controlled medicines for their populations. This obliga- tion is implied in the cornerstone treaty of the international drug control system, the Single Convention on Narcotic Drugs, and is firmly rooted in the right to the highest attainable standard of health in international human rights law” (Global Commission on Drug Policy, 2015).

There continues to be resistance to the importation of morphine powder in many African countries. This dates back to the myths still held by many doctors due to the negative messages instilled into them as medical students re the dangers of addiction to morphine and the need to avoid it at all costs. This teaching had been changed in most medical schools in the world as the recent advances regarding this were published to governments from WHO in 1986, but many Schools of Health Care Sciences in African Universities still teach this. Governments take their advice from the medical professionals and thus doctors continue to give this message.

Research and Advocacy

The World Health Assembly recently passed a resolution on strengthening palliative care as a core component as a component of comprehensive care throughout the life course (World Health Assembly, 2014). The resolution outlines responsibilities of WHO member states which are based on nine thematic areas of evidence based palliative care policies; funding and allocation of human resources; basic support to all care givers.
including families, volunteers and others; education and training at all levels; assessing basic palliative care needs including pain medication requirements; revision of national and local legislation and policies for controlled medicines to improve access; updating national essential medicines lists; fostering partnerships; and implementing and monitoring palliative care actions in the included in WHO’s global action plan for the prevention and control of NCDs 2013-2020. To support comprehensive integration of palliative care, the need for evidence is critical and indeed WHO’s commitment to strengthening palliative care highlights commitment to more targeted research; • monitoring global palliative care access and evaluating progress made in palliative care programmes; • encouraging adequate resources for palliative care programmes and research, especially in resource-limited countries; • building evidence of models of palliative care that are effective in low- and middle-income settings; • building evidence models of affordable oral morphine use in Africa without diversion or addiction.

The African Palliative Care Association in partnership with various academic institutions in Northern, Western, Eastern and Southern Africa as well as Europe and North America has established the African Palliative Care Research Network (APCRN) to train palliative care researchers, nurture a research culture and developments on the continent. The APCRN also coordinates international student placement scheme to support international researchers who wish to undertake research in Africa.

Through joint effort and collaboration, evidence base for palliative care in Africa has greatly improved over time; research conducted include a clinical trial evaluating the nurse led model of palliative care for HIV patients (Lawther et al, 2015) and another trial assessing the potential use of Amantadine for Analgesia in Painful HIV-Associated Sensory Neuropathy (Dinat et al, 2015). Research has also been conducted on understanding models of models of palliative care in Africa (Downing et al, 2015; Harding et al, 2014); appraisal of palliative care services in Africa (Wright et al, 2006). Studies have also been conducted on needs assessments for palliative care in Africa (Jacinto et al, 2015; van Niekerk et al, 2014; Herce et al, 2014) and this will inform planning for service delivery in the region.


Institutions engaging in palliative care research include academic institutions, hospital based palliative care units, hospices, APCA, National Associates with an anchor into collaborations and partnerships in institutions based in Europe, North America, and New Zealand. It is encouraging to note that most regions in Africa are actively participating in the dissemination of best practices through publication. This evidence is informing policy (Nabudere et al, 2014), Uganda, Rwanda, Swaziland and Malawi currently have standalone evidence palliative care policies. The evidence has also informed policy dialogues that have led to improved access to Opioids for pain management in countries like Uganda, (Meriman et al, 2010b), where trained nurses and clinical officers can now prescribe morphine and where local production has been embraced. More countries like Rwanda are talking local production which is cheaper and reduces waiting time between medicine ordering and delivery. There is however more need for capacity building and engagement in knowledge translation to increase use of evidence for informing policy, service development, delivery and general palliative care practice.

APCA has also established a triennial palliative care conference which is held every three years in different parts of the continent. This helps to create a forum where palliative care providers, researchers, educators, donors, governments, patients and the general public have an opportunity to meet and share best practices and research evidence. The previous conferences were held as follows, Arusha 2004, Nairobi 2007, Windhoek 2010, Johannesburg 2013 and the next one will be held in Kampala in August 2016.

As part of the palliative care conference of 2013 in Johannesburg, a minister of health palliative care session was held and this brought together delegations from 34 countries with ministers of health from Kenya, Uganda, Malawi and South Africa attending in person. The ministers’ session came out with a statement urging for integration (Jackson, 2013).

Partnerships and Coordination

The achievement of progress in palliative care implementation and training in Africa has been possible because of the north-south partnerships that exist between African ministries of health, training institutions and civil society players and their partners in Europe and North America. South-to-South partnership has also been useful especially as regards training where other African countries have utilised facilities in Cape Town South Africa and Hospice Africa Uganda and Makerere University in Uganda to develop palliative care human resources (African Palliative Care Association Annual Report 2012/13). However, African palliative care needs a greater input from African academics and the communities. There is so much in Africa that Western countries could learn from, particularly in keeping costs down, which African teams are forced to do in order to have an affordable service.

Other key players include the medical and human rights players in supporting the unique challenges of palliative care patients as professional councils with an anchor into collaborations and partnerships in institutions based in Europe, North America, and New Zealand. It is encouraging to note that most regions in Africa are actively participating in the dissemination of best practices through publication. This evidence is informing policy (Nabudere et al, 2014), Uganda, Rwanda, Swaziland and Malawi currently have standalone evidence palliative care policies. The evidence has also informed policy dialogues that have led to improved access to Opioids for pain management in countries like Uganda, (Meriman et al, 2010b), where trained nurses and clinical officers can now prescribe morphine and where local production has been embraced. More countries like Rwanda are talking local production which is cheaper and reduces waiting time between medicine ordering and delivery. There is however more need for capacity building and engagement in knowledge translation to increase use of evidence for informing policy, service development, delivery and general palliative care practice.

In Africa there is a shortage of doctors and even nurses especially in rural areas. The need for community-based resources to complement Hospice and Palliative Care teams is therefore necessary. Community Volunteer Worker (CVW) (Jack et al, 2011) programmes have been developed by some countries (Uganda, Kenya, Malawi etc) to train lay people who are identified by their own local villages to help by providing support to
patients in their own homes. The CVWs are the Palliative Care team’s “eyes and ears” in the community whose hands bring basic nursing care into the home. CVWs assist collect patient medications from the health centre/hospital, and promote adherence to treatments. There has been much value shown by these programmes with CVWs acting as a ‘bridge to the hospice’ in identifying patients who would otherwise not have received any care (Jack et al, 2011).

Traditional Healers and Remedies in Palliative Care

Traditional healers have been part of the fabric of care in Africa since time immemorial and many molecules purified in the laboratory into tablets have their origins from plants and other natural materials found in the forests. The biggest challenge with traditional remedies is that some have not been well researched and without standardisation it is difficult to specify doses and combine treatments for the concern of side effects. It is nonetheless important to recognise that many patients will concurrently use traditional remedies during their Palliative care and the clinician will need to watch for drug interactions and side effects. Palliative Care however recognises that herbal remedies may represent valid local alternatives to the scarce and unaffordable modern medicines for the treatment of pain and symptoms. In some countries like Uganda and Malawi Palliative Care practitioners are working with traditional healers to identify useful remedies and there are training courses in PC for traditional healers who in turn invite the professional interdisciplinary teams to learn about herbal remedies in and from their forests. There is increasing interest in traditional medicine becoming an integral part of health policy through collaboration or integration. With research more remedies, like frangipani sap for the treatment of pain of herpetic vesicles as well as post herpetic pain, will become regularly used treatments.

Sap from the frangipani tree when topically painted on herpetic vesicles, and post herpetic area of pain, brings pain relief.

Figure 13: Pain relief for herpes can be obtained from the sap of the frangipani tree

Complementary Therapies in Africa

Unless overtly harmful it is important that anything which improves the quality of life of the patient should be encouraged. The psychological support which many complementary therapies offer must be appreciated. Complementary therapies used together with conventional treatments offer a more holistic approach to care and promote pain relief as a relaxed patient has a higher pain threshold. Acupuncture, aromatherapy, reflexology, massages, and distraction techniques are being increasingly used including in oncology units when added on therapies to benefit patients. The placebo effect is real and must not be scorned.

Role and Influence of Religions and Spirituality

Religion and spirituality are part and parcel of the fabric of the people of Africa and in offering holistic care health workers must recognise this and address issues of patient’s spirituality. Everyone has a spiritual dimension to his/her being, and spirituality is about what gives us meaning in our lives, our beliefs and values, and our ultimate concerns particularly when patients are facing life-limiting illnesses like cancer. At the end of life spiritual issues become increasingly important and it is often at this stage that patients can often experience significant spiritual growth and gain meaningful fulfilment.

Although spirituality is important in care of cancer and other palliative care patients talking about spirituality is a very personal matter, and good listening and communication skills and a trusting relationship needs to be developed in order to bring the discussion to a greater depth. A patient’s experience of physical pain may be worsened by spiritual distress, and sometimes spiritual pain is diagnosed after the failure of the patient’s physical pain to respond to increased doses of analgesia.

It is important that clinicians are not judgemental, do not try to convert patients to another faith but recognise that it is a time to listen to the person facing death, and respect his or her wishes and needs. Some oncologists and health workers find caring for people with cancer in the end stage of life challenging, and all too often when faced with difficult questions or situations there is a tendency to give false reassurances to try to make the patient feel better. It is also important to remember that in Africa some religions and faiths may interfere with the continuation and completion of cancer treatment and palliative care, for example when miraculous cure is sought by patients and their families.

Each professional has a role to play in dealing with spiritual issues and an interdisciplinary model of oncologic and palliative care that includes spiritual support is intended to ensure that patients receive the best care. Reference to a religious leader or pastoral worker should always be considered for patients, but in our experience most patients have developed their own way of supporting their relationship with their God and are grateful if the health care professional shows empathy and understanding of this. Therefore a section on spirituality is included in patient assessments in palliative care in Africa.

Legal and Human rights approaches to palliative care

Legal, ethical and Human Rights issues are now a recognised field within palliative care and countries such as Kenya, Uganda, and Malawi have developed guidelines on this topic for health care workers as well as families.

Leveraging the policies and system for cancer, HIV, tuberculosis, for palliative care delivery

Because of the decline in funds for palliative care over time and given the burden, all funds for the various disease programmes such as tuberculosis, HIV and cancer ought to be used to offer palliative care as part of an integrated approach to suffering.

Figure 14: Therapies for the desperate - Nanyonga’s “garden soil cure” for HIV/AIDS - With permission from Prof Peter Mugyenyi
Many HIV organisations have been trained in palliative care although few were able to practice it fully due to pressure from donors for numbers, which are reduced when time is given to those in need of palliative care. However as the epidemic is reducing in the countries above the South of Africa, these people are a rich source of palliative care human resource in the future.

Working closely together with oncologists, sharing resources according to patient’s needs and expertise in our clinical programs and in education and training programmes, we will bring relief to those with total suffering in Africa, and in the words of Hippocrates:

“Cure sometimes, treat often, comfort always.”

References


The 2015 Quality of Death Index.
Liver cancer is the first cause of death by cancer in men (13% of all cancer deaths) and the third in women (6%) across the African continent (Jemal et al., 2012). Incidence and mortality rates are almost equal, underlining the lack of curative treatment options. Based on clinical case series, the majority of African liver cancers are hepatocellular carcinomas (Umoh et al., 2011), a cancer that develops from the cells of the liver parenchyma (the hepatocytes), often as a sequel of a chronic infectious and inflammatory liver condition. Other forms of liver cancer are rare, including intra-hepatic cholangiocarcinoma (CC), a cancer of the epithelial cells lining the biliary ducts (the cholangiocytes). In high-resource countries, CC represents about 10-15% of all cases of liver cancer and its incidence is rising (Bruix et al., 2015). CC occurs at high rates in regions of South East Asia where infections by liver flukes (flatworms) are widespread. In Africa, CC is relatively frequent in Egypt but represents less than 5% of the cases documented in clinical series in sub-Saharan Africa (Otegbayo et al., 2006). These figures, however, should be taken with caution since histological diagnosis is available for only a fraction of the liver cancer cases detected on the continent.

The main causes of liver cancer in Africa are chronic infections with Hepatitis B Virus (HBV) and to a lesser Hepatitis C Virus (HCV), compounded by exposure to aflatoxins, a class of carcinogenic mycotoxins that contaminate food commodities in Western and Central African countries (Franceschi and Raza, 2009; Hall and Wild, 2003; Hoshida et al., 2012; Kirk et al., 2006; Montesano et al., 1997). The main form of aflatoxin in the food is aflatoxin B1 (AFB1), a demonstrated mutagen in hepatocytes. HBV and HCV have strong and multifactorial oncogenic properties. Aflatoxins, chronic HB and chronic HC infections are all classified as Group 1 carcinogens by the International Agency for Research on Cancer (IARC) (Pearce et al., 2015). Together, these factors account for well over 75% of the risk of hepatocellular carcinoma across sub-Saharan Africa. Preventive strategies to reduce the effects of these factors are available: a safe and efficient neonatal HBV vaccine has been introduced in the mid-eighties and reduction of aflatoxin exposure is achievable through several methods, including improved agricultural processes and diversification of the diet towards non-contaminated diets. However, these measures will take decades to reveal their full impact and, to date, their effect on the reduction of the rates of liver cancer is not yet perceptible. In the meantime, the population of Africa is expanding at an unprecedented pace, from about 1.2 billion in 2016 to a predicted 2.5 billion in 2050, with an increase of over 200% of those aged over 60 years, the age at which HCC most frequently occur in the rest of the world (https://populationpyramid.net/africa/2050/). Thus, the death toll by liver cancer in Africa will continue to increase at least until circa 2050-60, when most subjects aged 60 would have been vaccinated against HBV at birth. Therefore, we must be prepared to...
see at least a doubling of African liver cancers death until 2050 with dramatic human, social and economic consequences, making it one of the worst cancer epidemics worldwide.

In 2008, we proposed an action plan of 36 measures to curb the African liver cancer epidemics in the period 2010-2050 (Hainaut and Boyle, 2008). These measures included four domains for action: rolling out and assessing sustainable vaccination against HBV, reducing exposure to aflatoxins, monitoring and preventing the spread of HCV, and developing early detection, diagnosis and treatment of chronic liver disease and cancer. In this chapter, I briefly summarize the current situation and knowledge on liver cancer in Africa, highlighting the few progress made since 2008, and I review the progress made in implementing the the “36 steps against liver cancer in Africa”.

Geography and Ecology of Liver Cancer in Africa

The burden of liver cancer is not uniform across the African continent. The GLOBOCAN database of the International Agency for Research on Cancer (http://globocan.iarc.fr/Default.aspx) provides estimates of incidence and mortality for all African countries, showing over 10-fold variations between highest (parts of Western Africa) and lowest (parts of Northern and South-Western Africa) incidence regions (Figure 1 A). These estimates should be seen as conservative, in particular for Central Africa. The lack of clinical infrastructure in many regions precludes accurate diagnosis and it is likely that a number of cases are neither diagnosed nor systematically reported. Rigorous data on incidence and mortality are scarce and incomplete for most African countries. There are only 5 national cancer registries and less than 50 regional registries, the latter mostly covering urban areas, altogether covering about 5% of the African population, with a quasi-absence of formal data for Central Africa. The highest incidence rates are observed in The Gambia, the only country where liver cancer is actively registered in the context of the Gambia Hepatitis Intervention Study (Bah et al, 2013). Moreover, incidence rate estimations by country do not accurately reflect the differences that may exist across regions in large countries with contrasted populations and ecological patterns, such Mali, Niger, Sudan, RDC Congo or South Africa. In countries of the Sahel, liver cancer occurs at much higher rates in the semi-tropical South than in the arid North.

According to GLOBOCAN, the estimated overall incidence for liver cancer across the continent was 11.3 per 100,000 in men and 5.3 per 100,000 in women in 2012, roughly corresponding to about 50,000 cases in men and 25,000 cases in women. Broadly speaking, these areas with contrasted incidences can be distinguished. Areas of high-incidence cluster into an “African liver cancer belt” that forms a crescent-shaped zone running across Western and Central Africa but leaves out most of eastern Africa (Figure 1).
The State of Oncology in Africa – 2015

Lower incidence rates are observed in regions north, south and east of the belt, with a few notable exceptions. In northern Africa, rates are in the range of 3.5–10 per 100,000 in both men and women, except in Egypt, where an unusually high burden of chronic liver disease and HCC has been caused by the iatrogenic spread of Hepatitis C Virus (HCV) during mass intervention campaigns against liver flukes (Schitosoma haematobium), a parasitic infection causing bladder and pancreatic cancers (Strickland, 2006). In Eastern Africa, low rates are reported in Ethiopia, Tanzania, and Malawi (<2 per 100,000), whereas rates are lower than the African average in Ethiopia, Somalia, Kenya and Mozambique.

Trends in incidence suggest that the burden of liver cancer has remained practically unchanged over the past 30 years. However, there is evidence for an increasing trend in women. In The Gambia, comparison between cancer registration data from 1986-1997 and 1998-2006 revealed that rates remained relatively stable in men (from 32.84 to 32.84 cases per 100,000 in the first and second period, respectively) whereas in women rates increased from 11.71 to 14.9 cases per 100,000, with an Annual Percentage Change (APC) of 3.01% and increase in the absolute number of cases of 80.28% (compared to 26% in men) (Sijikoko et al, 2011). This trend may underlie the growing impact of risk factors for liver cancer such as metabolic disorders associated with obesity, physical inactivity and/or diabetes type 2. Indeed, time trend analyses indicate that the prevalence of obesity in urban West Africa had more than doubled (114%) over 15 years, accounted for almost entirely in women (Abubakari et al, 2009).

Most of the African liver cancer belt coincides with the hot and humid climates that characterize the inter-tropical zone. Within this zone, the highest incidence rates appear to be at the junction between humid and semi-arid climates in West and Central Africa, in the regions of maximal amplitude of change in the vegetal cover between humid and dry seasons (Figure 1 B). The map of this high incidence area overlaps with that of production of groundnuts (peanuts), one of the main sources of contamination of the diet by aflatoxins (Figure 1 C). This area also shows the highest levels of endemicity for Hepatitis B Virus (HBV) carriage (Figure 1 D). Strikingly, the regions of highest incidence within the belt correspond to countries where the major form of HBV in chronic carriers is Genotype E, whereas incidence rates are lower in regions with limited distribution of Genotype A (Southern and Eastern Africa) or D (Northern and Eastern Africa) (Figure 1 E). Outside the belt, the most prevalent cancers are cancers of lung (Northern Africa), oesophagus (Eastern Africa) and prostate (South-Western Africa) in men and breast cancer in women. The maps presented in Figure 1 show illustrate the strong ecological correlations between climate, vegetation, agriculture and viral infections, characterizing the African liver cancer ecosystem. Together, these characteristics not only determine the prevalence of exogenous risk factors for liver cancer: they also shape the infectious, immunological and inflammatory patterns affecting the people living in these areas.

Diversity of HBV Genotypes and Risk of Liver Cancer

HBV carriage is endemic throughout sub-Saharan Africa and is not restricted to the zones of the African liver cancer belt. Rates of carriage are consistently above 8% not only in the high-incidence regions of Western and Central Africa, but also in regions of Eastern and South-Western Africa where the rates of incidence of liver cancer are substantially lower (Figure 1, map C). In The Gambia, chronic HBV carriage is detected in about 15% of the subjects born before the initiation of the neonatal vaccination program in 1986. In Mali, a recent study in a cohort of volunteers from Bamako city has detected a rate of carriage of 18% in (non-vaccinated) adults aged over 18 years (Traore et al, 2015). There are, however, considerable local variations in the rate of HBV carriage. For example, in The Gambia, rates of 36% and 17% have been observed in the children of rural villages and the children of urban areas, respectively. Overall, the prevalence of chronic HCV carriage appears to be lower in Western Africa (1-2%). In The Gambia, successive case-control studies conducted between 1986 and 2000 have shown a cohort effect for HC carriage (Kirk et al, 2004), suggesting a possible iatrogenic spread due to unidentified interventions. In Northern and Southern Africa, sub-aemic rates of HBV carriage are observed, together with a higher prevalence of HC carriage, culminating in Egypt, where HC carriage is detected in over 20% of the male population (see above).
HBV (and HCV) are genetically diverse groups of viruses that occur as distinct genotypes, each prevalent in defined geographic areas (Figure 1, map D). HBV genotypes are defined as forms that differ between them by at least 8% of viral DNA sequence (Pujol et al., 2009; Sunbal, 2014). Genotype E is by far the most prevalent form in the regions of high incidence of Western and Central Africa. This genotype is rarely detected in other parts of the world (with the exception of limited regions of African immigration in the Caribbean and in Latin America) and represents up to 90% of the virus популяции in the circulating populations of The Gambia, Senegal and Southern Mali. It differs from other HBV genotypes by its homogeneity – there are no defined sub-genotypes-and by the relatively mild course of the acute hepatitis it causes in children and adolescents. Genotype D is the main genotype in Nigeria and its region of high prevalence extends across the Middle East, Central Asia and India. Genotype A is a genotype of Western European origin, which dominates in Southern and Eastern Africa. Genotypes B and C, the most prevalent genotypes in south-eastern Asia, and the less common genotypes F, G, H, and I are virtually absent from Africa (Pujol et al., 2009; Sunbal, 2014). HB genotypes show differences in their mode of transmission, their rate of carriage acquisition and the characteristics of acute and chronic diseases they cause in infected subjects (Kao, 2002). They also infect newborns and children, either through vertical transmission from carrier mothers during delivery, or horizontal transmission by saliva or blood contacts in the first months of life. Younger age at infection increases the risk to become HB carrier (Kirk et al., 2004). Transmission of Genotype E appears to be predominantly horizontal, with only few children becoming infected at birth from carrier mothers with high viral loads (Visvanath et al., 2008).

Clinical Patterns of Liver Cancer and Trajectories of Chronic Liver Diseases

In high-resource countries, HCC typically develops at an average age of 65-70 years in patients with clinical history of chronic metabolic and immuno-inflammatory liver disorders characterised by progressive liver fibrosis and/or cirrhosis. Over 80% of the patients diagnosed with HCC have a previous diagnosis of cirrhosis (Brux et al., 2015). In regions of high incidence of Africa, the situation appears to be quite different. First, most liver cancers develop at a much earlier age than in industrialized countries, in particular in patients with chronic HB. In a case-control study in The Gambia, the mean age at diagnosis was 48.1 ± 15.2 years (Kirk et al., 2004). A recent survey in 1525 histologically confirmed patients from 14 centres across sub-Saharan Africa has reported that the mean age at HCC diagnosis was 42 years (Interquartile range, IQR: 34–55) in patients with chronic HB and 55 years (IQR: 46-65) in patients with chronic HC. The most frequent age range for HCC diagnosis in HB carriers was 32-37 years and 43% of HB-related HCC cases occurred before age 40 years (Yang et al., 2015). Second, cirrhosis does not appear to be an obligate precursor for HCC. In a case-control study in The Gambia, histological signs of cirrhosis were present in 62% of the patients at the time of HCC diagnosis (Simoh et al., 2011) but only a minority of the patients had received a diagnosis of cirrhosis prior to HCC. In particular, cirrhosis was seldom detected as precancer in young patients (<35 years). The majority of the patients presented with advanced HCC (84% of the cases), with a genotype of Western European origin, which dominates in Southern and Eastern Africa. Genotypes B and C, the most prevalent genotypes in south-eastern Asia, and the less common genotypes F, G, H, and I are virtually absent from Africa (Pujol et al., 2009; Sunbal, 2014). HB genotypes show differences in their mode of transmission, their rate of carriage acquisition and the characteristics of acute and chronic diseases they cause in infected subjects (Kao, 2002). They all infect newborns and children, either through vertical transmission from carrier mothers during delivery, or horizontal transmission by saliva or blood contacts in the first months of life. Younger age at infection increases the risk to become HB carrier (Kirk et al., 2004). Transmission of Genotype E appears to be predominantly horizontal, with only few children becoming infected at birth from carrier mothers with high viral loads (Visvanath et al., 2008).
Overall, these molecular characteristics allow distinguishing between two main classes of HCC. Class I consists of poorly differentiated tumours associated with HBV, occurring early (age <60 years) and containing inactivating alterations in the TP53 pathway. Class II includes well-differentiated tumours associated with HCV and/or other aetiologies, occurring mostly at age >60 years and containing activating alterations in the WNT pathway (Figure 3). Further integration between genomics and transcriptomics allows subdividing these two broad classes into 6 subgroups of HCC (G1-G6), each associated with specific clinical and genetic characteristics. This classification has potential therapeutic implications since it identifies molecular targets that may be actionable using targeted therapies in about 50% of HCC.

Figure 3: Two distinct classes of Hepatocellular Carcinomas (HCC) based on molecular and clinical patterns

Class I HCC
- TP53 Mutations
- Poorly differentiated
- Tumour size >55 mm
- High grade/capsule
- High vascularization
- Age <60 years
- HBV
- No cirrhosis

Class II HCC
- CTNNB1 Mutation
- Well differentiated
- Tumour size <55 mm
- Age >60 years
- HCV
- Cirrhosis

Disease specific survival
HBV+ HCC

Number at risk

Month

Disease specific survival
HBV - HCC

Number at risk

Month

are already present at harvest but further accumulate during the storage period, causing a peak of dietary exposure to occur between December and March. Studies on children from The Gambia have documented that levels of AFB1-albumin adducts in the serum showed a strong seasonal variation, with the highest levels corresponding to the period of highest exposure to aflatoxins (Turner et al, 2000). Interestingly, copy numbers of mutant TP53 DNA also showed a seasonal variation between dry and wet seasons, but with different trends in HB carriers and non-carriers (Villar et al, 2011). These seasonal variations are summarized in Figure 4.

Top: Time chart representing the succession of wet (orange background; June-September) and dry (blue background, October- May) periods in West Africa. The red boxes marked “H” identifies the period of groundnut Harvesting. Blue and grey bars delineated the documented periods of higher and lower exposure to aflatoxin, respectively. The dotted line represents an estimate of the seasonal variation in exposure to aflatoxin. Bottom: detection of mutant TP53 DNA (aflatoxin-induced mutation, p.R249S, in copies per mL serum) in HB carriers (HBsAg-positive) and non-carriers (HBsAg-negative) subjects. Blue and grey arrows linking the top and bottom parts of the figure emphasize the contrasted patterns of mutant TP53 DNA variations between periods of high and low exposure to aflatoxin, respectively. The dotted line represents an estimate of the seasonal variation in exposure to aflatoxin. Bottom: detection of mutant TP53 DNA also showed a seasonal variation between dry and wet seasons, but with different trends in HB carriers and non-carriers (Villar et al, 2011). These seasonal variations are summarized in Figure 4.

Taken together, these results support the hypothesis that TP53 mutation and chronic HB cooperate together to shape the trajectory of liver cell fate may depend upon the balance between these two effects (Gouas et al, 2010; Gouas et al, 2012; Ng et al, 2016).

The mechanisms by which chronic HB contributes to hepatocarcinogenesis are complex and multiple. These mechanisms can be broadly divided into two types, specific and non-specific mechanisms. Non-specific mechanisms include liver damage caused by viral replication, leading to fibrosis, a wound-healing process characterized by the progressive replacement of hepatocytes by components of the extracellular matrix (Wallace et al, 2015). Specific mechanisms include the direct molecular effects of the virus itself, such as insertional mutagenesis by integration of viral DNA into the genome of host cells or oncogenic effects exerted by viral proteins, among which the HBx antigen. HBx is a multifunctional protein that controls the replicative life cycle of the virus by interacting with a multitude of cellular regulators involved in controlling entry into cell cycle, cell proliferation, mitotic spindle formation, transcription, DNA methylation and bioenergetics metabolism (Dai et al, 2014; Hodgson et al, 2012; Leverero and Zucman-Rossi, 2016; Slagle and Bouchard, 2016). By targeting these proteins, HBx accomplishes a wide series of molecular tasks geared at adapting hepatocytes to the requirements of HBV replication and production. The combined effect of the interference of HBx with these pathways may confer HBx the properties of a genuine dominant viral oncogene. However, the molecular biology of HBx is far from being understood. It has been proposed that distinct domains of the HBx protein may carry different functions, with some domains promoting cell replication whereas others may cause cell suppression, depending upon the cellular factors they interact with. Thus, the ultimate effect of HBx on cell fate may depend upon the balance between these two effects (Gouas et al, 2010; Gouas et al, 2012; Ng et al, 2016).

In chronically infected cells, HBx undergoes multiple mutational events, highlighting the rapid evolution of the gene under strong selective pressure. This adaptive evolution may enable HBx to exert different functions, depending of the stage of the natural history of infection. A number of reports have indicated that HBx is the most commonly integrated HBV open reading framed into the genome of liver cancer cells. In many instances, HBx is integrated in a truncated form, missing the C-terminal part of the protein that may be critical for its suppressive effects. This truncation may therefore activate the oncogenic properties of HBx. In HCC with aflatoxin-induced TP53 mutations, HBx is often integrated without truncation and the C-terminal part of the protein seems to form a stable complex with the mutant p53 protein (pR249S) (Gouas et al, 2010; Jiang et al, 2010). Thus, presence mutant p53 and its binding to HBx may neutralize growth suppression effects associated with the C-terminus of HBx, dispensing for the need of truncating that domain upon integration of HBx into the host cell genome. Interactions Between Mutant TP53 and HBV: Adaptive Response for Survival to Chronic Liver Disease? Interactions Between Mutant TP53 and HBV: Adaptive Response for Survival to Chronic Liver Disease?
The growth-suppressive effects of HBs while promoting its capacity to activate cell proliferation and liver regeneration. In principle, the short-term consequence of this effect is to alleviate HBV-induced liver damage and prevent fibrosis/cirrhosis, thus reducing the severity of HB-related chronic disease. The long-term consequence, however, is to give cells a head-start on the road to carcinogenesis by dramatically increasing their risk of neoplastic transformation. Figure 5 illustrates two distinct trajectories of progression towards liver carcinogenesis that may occur in different contexts.

The Gambia Hepatitis Intervention Study (GHIS) is an intervention trial jointly developed by The Government of the Republic of The Gambia, the Medical Research Council of United Kingdom, and the International Agency for Research on Cancer, in which 125,000 children born during the period of introduction of neonatal HB vaccination (between 1986 and 1990) are followed for 40 years through nationwide cancer registration to compare the incidence of HCC in vaccinated versus non-vaccinated subjects (Viviani et al, 2008). Since 1990, neonatal HB vaccination is available for the entire population of The Gambia. In the past 25 years, neonatal HB vaccination has been progressively rolled out in most African countries. By 2000, 7 countries had implemented nationwide HB vaccine coverage. By 2011, neonatal HB vaccination was available in 45 African countries, with reported coverage estimates varying between 22% in Chad to 99% in Eritrea (http://apps.who.int/immunization_monitoring/globalsummary/timeseries/tswcuvaccoverageeg.html). However, vaccine coverage is at best partial for the largest and most populated countries of the African liver cancer belt (Nigeria: 50%, RDC Congo: 75%; South Africa: 76%; Sudan: vaccination started in 2014, Ivory Coast: 62%; Cameroon: 66%; Niger: 75%; Mali: 72%; Mozambique: 76%). These estimates indicate that probably less than 60 to 70% of the population of the high incidence areas is currently covered by neonatal HB vaccination, and that in most places vaccinated subjects are currently less than 15 years old.

Although the evaluation of neonatal HB vaccination against liver cancer is still pending, data on protection against chronic disease are extremely encouraging. Most children vaccinated at birth are efficiently protected against chronic carriage at least until early adulthood. Although antibody titres were quickly during the first 5-10 years of life, subjects develop a robust immune memory and do not become chronic carriers when in contact with the virus at adolescence, even in the presence of a booster dose (van der Sande et al, 2007). Furthermore, given the predominant horizontal pattern of transmission, only a few vaccinated children become carrier from infection at birth, suggesting that there is no systematic need for post-exposure prophylaxis using anti-HB immunoglobulins (HBIG) (Viviani et al, 2008). Despite sporadic reports of HBsAg mutants, there is no evidence for outbreaks of escape HBV mutants in vaccinated populations. Thus, neonatal vaccination against HBV seems to be a realistic and efficient measure to prevent chronic HB carriage and possibly its life-threatening sequels, chronic liver disease and liver cancer. A re-evaluation of the GHIS trial in 2008 design has indicated that the first results of this intervention against cancer should be available in the years 2017-2020 (Viviani et al, 2008).

The two main risk factors for HCC in Africa, HB chronic carriage and exposure to AFB, are in principle preventable. Given the intractable nature of HCC, prevention is currently the only achievable approach to curb the liver cancer epidemics in Africa. A safe and efficient HB neonatal HB vaccine is available since the early eighties and its introduction in the WHO expanded immunization program (EPI) has been initiated in 1986 in The Gambia. The Gambia Hepatitis Intervention Study (GHIS) is an intervention trial jointly developed by The Government of the Republic of The Gambia, the Medical Research Council of United Kingdom, and the International Agency for Research on Cancer, in which 125,000 children born during the period of introduction of neonatal HB vaccination (between 1986 and 1990) are followed for 40 years through nationwide cancer registration to compare the incidence of HCC in vaccinated versus non-vaccinated subjects (Viviani et al, 2008). Since 1990, neonatal HB vaccination is available for the entire population of The Gambia. In the past 25 years, neonatal HB vaccination has been progressively rolled out in most African countries. By 2000, 7 countries had implemented nationwide HB vaccine coverage. By 2011, neonatal HB vaccination was available in 45 African countries, with reported coverage estimates varying between 22% in Chad to 99% in Eritrea (http://apps.who.int/immunization_monitoring/globalsummary/timeseries/tswcuvaccoverageeg.html). However, vaccine coverage is at best partial for the largest and most populated countries of the African liver cancer belt (Nigeria: 50%, RDC Congo: 75%; South Africa: 76%; Sudan: vaccination started in 2014, Ivory Coast: 62%; Cameroon: 66%; Niger: 75%; Mali: 72%; Mozambique: 76%). These estimates indicate that probably less than 60 to 70% of the population of the high incidence areas is currently covered by neonatal HB vaccination, and that in most places vaccinated subjects are currently less than 15 years old.

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Results from Taiwan, where HCC commonly develops in adolescents and young adults, have demonstrated that neonatal HB vaccination causes a strong and sustained decrease in the incidence of early liver cancer (Ni et al, 2016). This success has led to the general belief that neonatal HB vaccination will dispose of the long-term risk of liver cancer in high incidence areas of Africa and South Eastern Asia. However, a close examination of the data from Africa should dampen this enthusiasm, at least in the short and middle term. First, whereas the risk of HCC attributable to HB is over 90% in subjects <45 years, the lifetime risk is in the range of 70%, with the majority of cancers occurring in subjects >60 attributable to HCV and/or other aetiologies such as alcohol and chronic metabolic liver disorders. Second, as explained above, vaccine coverage was still
Early Detection: A Stepping-stone for Curative and Palliative Treatment

Curbing liver cancer epidemics implies curbing its mortality by improving cancer detection, diagnosis, management and therapy. To date, treatment of liver cancer in Africa is barely feasible because of the late presentation of most cases and because of the lack of clinical infrastructures. The only potentially curative option for patients with such advanced cancers in liver transplantation, which is not feasible in most clinical centres and in, any case, never represent an option for mainstream therapy. Other treatment options include surgery, percutaneous injection of alcohol or other cytotoxic agents into the tumour, radio-ablation or therapy using specific drugs. These options require that liver cancers be detected early, at a stage where therapy is still possible. Currently, less than 20% of the patients present with early disease potentially amenable to therapy (Umoj et al, 2011).

Diagnosis of HCC in the resource-constrained context of many African countries relies on the combination of clinical signs, ultrasonography findings and detection of elevated levels of alpha-fetoprotein (AFP). In The Gambia, the use of these criteria with an AFP cut-off level of 200 ng/ml showed an overall specificity and accuracy of 99.6% and 92.3% respectively, when compared with histologically confirmed diagnosis (Umoj et al, 2011). However, even these simple criteria are not always systematically used. Data from the National Cancer Registry from The Gambia indicate that, during the period 1998-2006, AFP testing was performed in less than 25% of the cases of liver cancer and that half of the tested cases were negative at a cut-off level of 200 ng/ml (Bah et al, 2013).

The short lag between the self-reported onset of first symptoms and diagnosis of advanced liver cancer (a few weeks) suggests that the disease may be present in a clinically occult form for a much longer period before its manifestation. This, in principle, provides a good opportunity for early detection. Screening is standard of care for patients at risk (e.g. patients with severe chronic liver disease) in high-resource countries, with ultrasonography at 3-6 monthly intervals as the current method of choice (Brux et al, 2013). There is no demonstration of the efficacy of ultra-sonography in a low-resource African context. Thus, the best option for anticipating diagnosis to potentially treatable stages of the disease is to identify specific biomarkers for early detection using simple and robust laboratory methods.

The current reference biomarker, alpha-fetoprotein (AFP), is of limited interest for screening since low levels of AFP are poorly specific for HCC. A number of other potential biomarkers have been proposed in recent years but none of them has demonstrated its applicability in low-resources contexts (Hu et al, 2013). Screening for the aflatoxin-induced TP53 mutation in DNA from the serum is not a reliable option since variable levels of mutational DNA are found in healthy subjects who are exposed to the mycotoxin and since only about half of HCC patients have the mutation in liver cancer cells (Villar et al, 2011). With this in mind, we have initiated an international collaborative effort aimed at discovering and assessing new serum biomarkers tailored for optimal applicability in detecting early HCC-related HCC. Using deep- plasma proteomics, two markers have been identified as performing better than AFP in discriminating cancer against chronic liver disease and cirrhosis, with sensitivities and specificities >90% for HCC associated with HBV (da Costa et al, 2013; Shang et al, 2012). These two markers are Osteopontin (OP) and Latent TGFbeta Binding Protein 2 (LTBP2), two components of the extracellular matrix of the liver. A recent evaluation of circulating OP levels in a prospective European cohort revealed that an increase in serum levels of OP was predictive of HCC up to 2 years ahead of diagnosis. After adjusting for all variables such as AFP and liver enzymes, each 10% increase in OP levels was associated with a significant increase of developing HCC after 2 years (OR multivariable=1.30, 95% CI: 1.14-1.48) (Duarte-Salles et al, 2016, in press). Testing of OP and LTBP2 can be performed using robust and low-cost immunoassays. Therefore, combining these two markers offer attractive characteristics for the screening of HCC in at-risk population groups but their efficacy remains to be evaluated in an African cohort.
In 2008, we proposed a set of 36 steps for reducing the mortality by liver cancer in Africa by the year 2050 (Hainaut and Boyle, 2008). These steps fall into 4 main areas: preventing HB carriage, mitigating aflatoxin exposure, treating HB and HCV chronic infections and chronic liver disease, and improving liver cancer detection, diagnosis and therapy. None of these measures on its own will be sufficient to significantly decrease the number of death by liver cancer in the next decades. To have a realistic chance of limiting the natural increase in liver cancer cases due to population expansion and ageing, several of these measures need to be combined into an organized and structured action plan for Africa. Table 1 lists these 36 steps and discusses the progress towards their implementation since 2008, highlighting that much remains to be done to fully implement them.

Table 1: 36 steps against liver cancer in Africa

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<td>Assess mutagenicity of aflatoxin in childhood, in relation to acquisition of chronic HB infection</td>
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<td>Develop ready-to-use field biomarkers to monitor individual exposures</td>
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<td>Understand mechanisms of synergistic effects between HBV and aflatoxin</td>
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<td>Develop and communicate recommendations on behavioural methods to reduce exposure</td>
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<td>Reducing exposure to aflatoxin (AFB)</td>
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<td>Inclusion of HBV vaccination in state-sponsored vaccination programmes</td>
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<td>Development of appropriate infrastructures for therapeutic clinical trials</td>
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<td>Work out vaccination programmes applicable in areas with poor coverage by vaccination teams</td>
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<td>Assessment of the effects of weight controlled deviations</td>
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<td>Work out and implement environmentally sustainable programmes for permanent reduction of HBV and HCV in step-upstream vaccination programmes</td>
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<td>Evaluation of the effectiveness of interventions on risk and exposure to HBV and HCV</td>
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<td>Reduction of exposure to HBV</td>
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<td>Reduction of exposure to HCV</td>
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<td>Assess the effects of antiviral/antiretroviral treatment on chronic liver disease</td>
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<td>Develop experimental model systems to assess novel pharmacological agents</td>
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<td>Support to existing registries should be maintained and expanded (eg, AFRO REGNET)</td>
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<tr>
<td>Develop experimental model systems to access new pharmacological agents on local scale for fulminant disease in Africa</td>
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<td>Assess the effects of antithrombotic treatment</td>
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<td>Develop appropriate infrastructure for phase II, phase III clinical trials</td>
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<td>Develop appropriate infrastructures for haemodialysis, clinical trials and blood transfusion</td>
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<td>Assess interactions between HCV and aflatoxin</td>
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<td>Develop appropriate infrastructures for phase I clinical trials</td>
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<td>Assess interactions between HBV and aflatoxin</td>
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<td>Develop and coordinate network of chronic liver disease registries</td>
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<td>Support dissemination of simple and robust imaging technologies</td>
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<td>Monitor long-term protection (vaccine effectiveness) of people vaccinated</td>
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<td>Bring current vaccination trials to final assessment in low-cost areas of disease eradication</td>
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<td>Understand mechanisms of occurrence of cancer in patients with no identifiable risk factors</td>
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<td>Develop appropriate infrastructure for adherence to vaccination campaigns</td>
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<td>Support to existing registries should be maintained and expanded (eg, AFRO REGNET)</td>
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<td>Monitoring the effect of HBV vaccination on state-sponsored vaccination programmes</td>
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<td>Work out and implement environmentally sustainable programmes for permanent</td>
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Perspectives: 36 Steps Against Liver Cancer in Africa

Economic growth and dietary diversification are expected to cause many changes potentially impacting on the incidence rates of liver cancer. On the one hand, better awareness and access to care will improve the prevention and management of chronic liver diseases. On the other hand, a switch toward westernized hypercaloric diet and lifestyles may result in a rapid rise in obesity, metabolic syndromes and diabetes,
thrust contributing to the increase of the prevalence of risk factors for liver cancer in both HBV carriers and non-carriers, including individuals in whom carriage has been prevented by neonatal vaccination. Monitoring these trends will be essential to sort out positive from negative impacts of these changes.

Access to diagnosis, treatment and palliation is dramatically constrained by economic resources. Yet, the trajectory of liver cancer in Africa will be the perfect paradigm for an alternative definition of health as “the expression in a person’s body of the characteristics of the ecosystem in which the person lives”. Indeed, the main risk factors for liver cancer are, so to speak, built in the ecosystems of West and Central Africa. Curbing the liver cancer epidemics will require careful and rational management of African ecosystems, taking into account economic growth, changes in agricultural practice, reduction of endemic diseases, in a context of population expansion and migration, and considering that climate change and deforestation may dramatically modify the ecology and economy of the countries in the area of high incidence of HCC.

References
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Chapter 10 - Africa: Cervical Cancer

Marc Arbyn, Magali Boniol, Philippe Autier*

Africa: Cervical Cancer

Cervical cancer is a preventable and curable disease, preventable by vaccination and screening and curable if identified at an early enough stage. Despite evidence for its high preventability, cervical cancer remains the first common cancer among women in Eastern Africa and the second most common in the other parts of Africa (Arbyn et al, 2011; Farley et al, 2015).

Brief Description of the Uterine Cervix Anatomy

The cervix is the lower part of the uterus that opens into the vagina. The lower opening in the vagina is called the "external os". The cervix is divided into two distinct anatomical entities, the exo-(or ecto-) cervix that extends from the external os to the vaginal wall, and endocervix which is the canal between the external to the internal os that ends into the uterine cavity. The epithelium covering the exocervix are squamous keratinocytic cells arranged in multiple layers similar to the vaginal epithelium. The epithelium covering the endocervix consists of one layer of columnar mucinous cells. The transformation zone (TZ) is the transition between multilayer squamous and one-layered cylindrical epithelium. The anatomical position of the TZ changes with age: in young women (puberty to 20 years of age), the TZ is located on the ectocervix and is completely visible at colposcopy or other technique that enables visualisation of the cervix. With aging, the TZ migrates into the endocervical canal and after menopause, the TZ is no longer or only partly visible.

The Two Types of Cervical Cancers

There are two types of cervical cancer that have different cellular origins is squamous cell carcinoma (SCC: 80 to 90% of all cervical cancers) and adenocarcinoma (10% to 20% of cervical cancers). The SCC develops from the transformation zone (TZ). Nearly all cervical cancers originate from carcinogenic processes induced by long-lasting, persistent infection of the TZ by oncogenic HPV (human papillomavirus) types (mainly HPV 16 and 18 which cause approximately 70% of all cervical cancers). In this respect, it is the presence of a HPV virus in the cervix of women 30 years of age or more that represent the key risk factor for cervical cancer.

Pre-Malignant Lesions of the Cervix

Cervical intra-epithelial neoplasia (CIN) represents pre-malignant (or precursor) lesions, a fraction of which may evolve into invasive SCC if left untreated. CIN lesions are classified in three categories during the histology examination of cervical biopsies, CIN 1 being small and mild abnormalities that generally regress spontaneously; CIN 2 are larger lesions more susceptible to progress in CIN3 lesions, a fraction of which may progress into an invasive SCC. CIN lesions that are not too large can be treated with cryotherapy that is freezing of lesions at very low temperature with e.g., liquid nitrogen, which destroys the abnormal tissue. For larger CIN lesions, more aggressive treatment is needed, like local surgical excision under colposcopic control. Adenocarcinoma-in-situ can be considered as the precursor lesion of adenocarcinoma.

The Burden of Cervical Cancer in Africa

Available Data on Cervical Cancer Incidence and Mortality

Egypt and South-Africa are the two African countries that have reported cervical cancer mortality data for several years (World Health Organization, 2013). In Egypt, from 1955 to 1962, age-adjusted cervical mortality rates were stable at around 0.2 per 100,000 women. From 2000 to 2011, age-adjusted rates were stable around 0.3 per 100,000 women. In South-Africa, from 1993 to 2013, age-adjusted rates remained stable at around 12.1 per 100,000 women. Hence, according to these mortality data, the burden of cervical cancer over the last 10 to 20 years would have remained stable. However, one should bear in mind that the quality of death cause certification for cervical cancer is questionable since for a major part of deaths due to cancer of the uterus the anatomical origin (cervix or corpus uteri) is not specified. Hence trend analysis of mortality from cervical cancer is somewhat biased by the inclusion of deaths due to cancer of the corpus uteri (Arbyn et al, 2009). However, according to the Kampala cancer registry, cervical cancers would represent about 92% of all cancers of the uterus, and the remaining 8% would be the cancers of the corpus uteri (Wabinga et al, 2014).

Several cancer registries have reported incidence data from African countries to “Cancer in Five Continents”, volumes I to X (Ferlay et al, 2014) and in publications (Wabinga et al, 2014). All age-adjusted (World standard population) incidence data from 1953 to 2010 have been displayed in Figure 1. No registry covers an entire country. No data have been reported for Central African countries. Few registries have reported data for periods exceeding 10 years without interruption. Despite these huge limitations, Figure 1 clearly shows the very high incidence of cervical cancer in Eastern Africa, the intermediate position of Western Africa, and the lower incidence in Northern Africa (Figure 2). Regarding trends, from 1991 to 2010, 30% increases in incidence over 20 years have been reported by two population-based registries in Uganda. Similar increases were observed in Bamako (Mali) from 1989 to 1996. In Harare (Zimbabwe), steady drops in incidence took place from 1990 to 2002, followed by a steep increase in 2003-06. A publication by the same Zimbabwe National Cancer Registry suggests a continuing increase in incidence, from 62 per 100,000 women in 1991-95 to 104 in 2006-10 (Chokunonga et al, 2013). However, incidence trends of other cancers in women were more pronounced, such as for corpus uteri (5.2% annual increase), colorectal cancer (3.8% annual increase) or pancreas cancer (4.2% annual increase). It is uncertain whether increases were real or due to better ascertainment and reporting of cancer cases.
Because of the paucity of data on cancer incidence and mortality, the burden and evolution of cervical cancer in Africa are difficult to appreciate, and one needs to have recourse to statistical modelling exercises for estimating these rates.

Limitations of Statistics of Cancer Incidence and Mortality

One of the challenges to estimate the global burden of cancer is in the availability of death statistics. Only around 25% of the world population lives in countries with registration of more than 90% of births and deaths. Regions with mostly high income countries such as Europe, North America, and a few countries in East Asia and Oceania are fully covered by death statistics. In contrast, regions with low and middle income countries are poorly covered, and in Africa, very few data are available on causes of death or on cancer incidence.

There are two main sources for estimates of the global burden of cancer: the Global Burden of Disease (GBD) project (Institute for Health Metrics and Evaluation; http://www.healthdata.org/gbd) (Fitzmaurice et al, 2015; Forouzanfar et al, 2011) and the Globocan project of the International Agency for Research on Cancer (IARC) (Ferlay et al, 2010; Ferlay et al, 2012b). Unfortunately, estimates of the cancer burden from these two sources are not congruent because of the differences in methods used for estimating incidence and mortality rates in countries that do not collect the appropriate statistics.

The Global Burden of Disease project provides the most comprehensive estimate of global mortality and disability data. This study uses a wide range of data sources including death registration data, disease registry data, health facility data, and data from surveys and studies. Potential problems with this type of data include incomplete ascertainment, non-representativeness, instrument bias, misclassification and distortion. Adjusted health statistics correct for known biases in order to enhance the likelihood of generating valid, reliable and comparable health statistics. There is a need to extrapolate data for populations with no information, and to make extensive use of cause of death and epidemiological models to arrive at estimates for those countries without useable data (approximately 20% of all countries, mostly in Africa).

Globocan estimates are based on cancer registries which provide the data for cancer surveillance. In 2006, there were 449 different populations covered by population-based cancer registries in the world producing cancer incidence data covering approximately 22% of the world’s population (Curado et al, 2009). Although only about half of these registries (in number and coverage) produce data of sufficiently high quality for inclusion in the periodic volume of standard comparative statistics (‘Cancer Incidence in Five Continents’), the remaining registries, especially in low- and middle-income countries, nevertheless provide valuable data for the purpose of making estimates.

In many low- and middle-income countries, cancer registration faces significant challenges, including the low priority given to cancer control, lack of trained personnel, lack of expertise in data processing, lack of personal identifiers, unstable populations and lack of census data.

Alternatives to population-based registries such as hospital registers, pathology registers and hospital episode statistics are second-best solutions. Hospital-based cancer registries are common but suffer from the inability to estimate the denominator in any analysis, and this may lead to serious biases. Moreover, in low-resource settings, many people with highly fatal cancers, such as liver and pancreatic cancer, do not go to hospital and therefore are not counted.

There is still much to be done to ensure better coverage of vital statistics at the global level and more consistent and accurate estimates of specific causes of death, including cancer.
The State of Oncology in Africa – 2015

The State of Oncology in Africa - 2015

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5.6
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444,500
2000
31.5
Western Africa
230,200
0.3
7,900
27.6
2,200
0.3
1.5
284,800
11.2
16.0
3.0
Developing regions
2010
2.7
3.4
21.7
11.4
0.8
Cumulative risk, age 0-74
ASR
0.5
29.3
2.0
N cases
3.0
1,100
Developed regions
46,000
6.4
0.4
1.7
7.6
83,200
7.4
World
3.4
15.2
1.2
1.7
1.0

The Estimated Incidence and Mortality of Cervical Cancer

For both Globocan and the GBD project, the highest rates of incidence and mortality of cervical cancer are observed in Sub-Saharan Africa. The Globocan project has estimated an age-adjusted (World population) average of 28 cases and 18 deaths per 100,000 women in 2012, peaking to 43 and 28 per 100,000 women in Eastern Africa (Table 1). It was estimated that 57,400 women died from cervical cancer in Sub-Saharan Africa in 2012 which represents 23% of all cancer-related deaths in women (Ferlay et al, 2012a). Breast and liver cancers were the cause of death for 17% and 5% of all cancers, respectively.

Table 1: Incidence and mortality of cervical cancer by regions and sub-regions in the world and in Africa (estimations for 2012)

<table>
<thead>
<tr>
<th>Region</th>
<th>Incidence</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N cases</td>
<td>Crude rate</td>
</tr>
<tr>
<td>World</td>
<td>25,700</td>
<td>26.0</td>
</tr>
<tr>
<td>Low developed region</td>
<td>444,000</td>
<td>15.6</td>
</tr>
<tr>
<td>High developed region</td>
<td>83,100</td>
<td>13.0</td>
</tr>
<tr>
<td>Africa*</td>
<td>89,000</td>
<td>18.5</td>
</tr>
<tr>
<td>Northern Africa</td>
<td>3,800</td>
<td>7.6</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>11,900</td>
<td>22.0</td>
</tr>
<tr>
<td>Eastern Africa</td>
<td>46,800</td>
<td>23.9</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>17,400</td>
<td>17.2</td>
</tr>
<tr>
<td>Southern Africa</td>
<td>6,900</td>
<td>29.3</td>
</tr>
<tr>
<td>Middle Africa</td>
<td>27,900</td>
<td>17.2</td>
</tr>
<tr>
<td>Americas</td>
<td>83,200</td>
<td>17.2</td>
</tr>
<tr>
<td>Asia</td>
<td>30,400</td>
<td>13.7</td>
</tr>
<tr>
<td>Europe</td>
<td>36,400</td>
<td>15.3</td>
</tr>
<tr>
<td>Europe*</td>
<td>2,400</td>
<td>11.7</td>
</tr>
</tbody>
</table>

Rates are per 100,000 women; ASR: age-standardised rate (World standard population)
* Countries part of the different sub-areas are in the chapter annexes.

The epidemiological picture is quite different in Northern African countries, where cervical cancer accounts for 4% of all cancer related deaths in women, well below breast cancer that accounts for 23% of all cancer deaths, and liver and colorectal cancers that account for 8% and 6% of all cancer deaths, respectively.

According to Globocan, the incidence of cervical cancer in sub-Saharan Africa steadily increases after 20 years of age, and peak ages are between 40 to 54 years of age. After 65 years of age, the incidence somewhat decreases with age.

The Globocan and the GBD project have estimated the cumulative risk of cervical cancer in women (Table 2). The estimates for the years 2010 (GBD project) and 2012 (Globocan) are comparable. However, the GBD project has estimated that overall, the lifetime risk that a woman would be diagnosed with a cervical cancer has decreased from 1980 to 2010, and these decreases are observed in all the World including in Africa (Fermaurice et al, 2015; Forouzanfar et al, 2011). In contrast, the Globocan estimates suggest decreasing cumulative risk for the world, but not for Middle, Eastern and Southern Africa, where cumulative risks would be on the rise (Ferlay et al, 2010; Ferlay et al, 2012b). These contrasting trends may be due to the known tendency of models used by the GBD project to obtain overoptimistic predictions. As a matter of fact, the GBD estimates for the burden of cervical cancer are systematically below what is observed by population-based cancer registries (Bray et al, 2012).

It is expected that in the near future, access to HPV vaccination will become more widespread in Africa. The evaluation of the long-term impact of vaccinations on cervical cancer incidence will critically depend on methods used for estimating the burden of cancer in these countries. Population-based cancer registries should have the lead in these evaluations.

Table 2: Estimated cumulative risk of being diagnosed with a cervical cancer

<table>
<thead>
<tr>
<th>Region</th>
<th>Cumulative risk, age 15-79</th>
<th>Cumulative risk, age 0-74</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GBD project</td>
<td>Globocan</td>
</tr>
<tr>
<td>1980</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>1990</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>2000</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>2010</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Ferlay 2008</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Ferlay 2012</td>
<td>0.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

* no data for all Africa,

(Ferlay et al, 2010; Ferlay et al, 2015; Forouzanfar et al, 2011)
Risk Factors for Cervical Cancer

Risk Factors for CIN Lesions and for Cervical Cancer

The persistence of oncogenic HPV types in the cervix is a necessary cause for the occurrence of cervical cancer (World Health Organization, 2007) and therefore the epidemiology of HPV in humans strongly correlates with risk factors for cervical cancer. A number of epidemiological studies have studied risk factors for CIN 2/3 lesions and for cervical cancer within the African context (Sudenga et al, 2015; ter Meulen et al, 1992).

Most factors that increase both HPV acquisition, transmission and promote the oncogenic effect of the virus are widespread in Africa. These are:

- young age at marriage or first sexual intercourse (i.e., before age 15 or 16 years)
- a high number of sexual partners
- polygamy
- a partner that has sexual intercourse with other partners
- unprotected sexual intercourse (e.g., non or infrequent use of condoms, diaphragms or gels)
- a history of sexually transmitted infections or diseases
- low education, deprivation
- non-attendance or non-access to cervical cancer screening

In women infected with HPV, several co-factors further increase the risk of progression to cervical cancer. These are (number of full-term pregnancies - see below), the use of oral contraceptive for 5 years or more, and tobacco smoking (Appleby et al, 2006; International Collaboration on Epidemiological Studies of Cervical Cancer, 2006).

Risk factors for persistent HPV infection of the cervix are repeated HPV infections and increasing viral load (Grabowski et al, 2014; Gavril et al, 2007), and some factors are strongly correlated with the younger age at first sexual intercourse, having more than one lifetime sexual partner, and having a high-risk partner (Fukuchi et al, 2009). In addition, oncogenic types of HPV are those more likely to persist in the cervical epithelial cells (Jaisamrarn et al, 2013). Reasons why in some women the oncogenic HPV strains can escape recognition by the host immune system is still unclear (Grabowski et al, 2012).

Worldwide regularly updated reviews of HPV strains found among women with normal cytology results are maintained by the ICO (Institut Català d’Oncologia) Information Centre on HPV and Cancer (Bruni et al, 2015). According to these reviews, the prevalence of HPV infection in adult women adjusted for age using the world reference population is 24% in sub-Saharan Africa with a peak of 34% in Eastern Africa, compared to a prevalence of 9% for Northern Europe and North America, and 12% for all less developed countries (Bruni et al, 2010).

Of more than hundred known HPV types, there are thirteen oncogenic HPV (i.e., HPV capable to induce malignant transformation), the two most frequently being the HPV types 16 and 18 that are found in 50% of CIN 2/3 lesions and in 70% or more of all cervical cancers in Africa (Al et al, 2011; Ramogola-Masire et al, 2011). A large study in women with histologically confirmed cervical cancer in Ghana, Nigeria and South Africa found HPV 16 in 51% of cases, HPV 18 in 17% of cases, HPV 35 in 9% of cases and HPV 45 in 7% of cases (Denny et al, 2014). HPV25 and HPV45 are more frequent in Africa than other parts of the World (Al et al, 2011). Of note, a large review of biological materials archived in biobanks found that the predominance of HPV 16 and 18 strains in cervical cancer occurrence is retrieved among HIV-infected women (Gyembo et al, 2015).

Genital warts are mainly caused by types 6 and 11.

The Role of Parity

Parity is the number of children born alive to a woman. Parity is a known risk factor for cervical cancer (castleffague et al, 2003). Reasons why high parity would favour the occurrence of this cancer are still debated. High parity could be a surrogate measure of more sexual contacts and of low socioeconomic status, factors that are themselves associated with a higher risk of cervical cancer. However the other explanation maybe mechanical. As women age, the transformation progressively climbs up into the endocervical canal, and after menopause, it is no longer, or only partially visible during colposcopy. A study in a large sample of women using cervicography (an optical system resembling to colposcopy) has demonstrated that the higher the number of livebirths, the longer the transformation zone stays on the external part of the cervix (Autter et al, 1996). And the longer the transformation zone remains on that external part, the more it keeps being exposed to infectious agents, including repeated HPV infections, all factors that maintain high levels of inflammatory processes in the cervix which contribute to the occurrence of cancer (Adefuye et al, 2012).

Of all world areas, parity is highest in sub-Saharan Africa. While from 1950-55 to 2007, parity has dropped by 40 to 60% in all continents, it has decreased by only 18% in sub-Saharan Africa, from a mean 6.7 live births in 1950-55 to 5.5 in 2007 (United Nations, 2007). In 2014, of the 50 countries with highest parity rates above a mean of 4 live births per woman, forty were sub-Saharan countries (Population Reference Bureau, 2015). In this regard, the permanence of a high parity may contribute to the high burden of cervical cancer in sub-Saharan Africa.

Impact of the HIV-AIDS Epidemic

The AIDS epidemic that erupted in 1982 mainly affected sub-Saharan populations. The immune suppression caused by the HIV infection is at the origin of a greater susceptibility to infectious agents, including HPV. Studies in all parts of the World have documented ten to thirty-fold increased risk of HPV-related lesions and cancers (e.g., genital warts, CIN lesions, anal and vulvar cancers) in AIDS patients or in HIV-infected subjects without AIDS (Denslow et al, 2014; Sie et al, 1998). In Africa too, HIV-positive women have a 2 to 12-fold higher risk of CIN lesions compared with

HI AND HPV INFECTIONS INFLUENCE EACH OTHER, BECAUSE BOTH ARE ASSOCIATED WITH A SAME SEXUAL BEHAVIOUR; AND BECAUSE HIV-INDUCED IMMUNE DEPRESSION INCREASES THE TOXICITY TO HPV INFECTION. LONGITUDINAL STUDIES HAVE SHOWN THAT BEING HIV INFECTED IS ASSOCIATED WITH A 5-FAITH INCREASED RISK OF PERISTING HPV INFECTION (ADLER ET AL, 2015) AND WITH A WIDER RANGE OF HPV TYPES. IN THEIR TURN, WOMEN AND MEN WITH GENITAL HPV INFECTION HAVE A NEARLY TWO-FAITH INCREASED RISK OF BEING INFECTED WITH HPV (SMITH-MCCUNE ET AL, 2010; SMITH ET AL, 2010).

THE RISK OF CERVICAL CANCER IN HIV-POSITIVE WOMEN IN EUROPE AND THE USA IS 3 TO 9 TIMES GREATER THAN IN NON-HIV-INFECTED WOMEN (CHATERVARI ET AL, 2009; CLIFFORD ET AL, 2005; ENGELS ET AL, 2008). HIGHER RATES OF CERVICAL INFECTIONS WITH HPV ARE FOUND AMONG HIV-INFECTED AFRICAN WOMEN. SOME CASE-CONTROL STUDIES IN AFRICA DEMONSTRATED A HIGHER RISK OF CERVICAL CANCER AMONG HIV-INFECTED WOMEN, FOR INSTANCE THE ODDS RATIO WAS 6.5 (95% CI 2.1 TO 19.8) IN DAKAR, SENEGAL (HOLMES ET AL, 2009). HOWEVER, OTHER STUDIES IN AFRICA FOUND A LESS INCREASED RISK OF CERVICAL CANCER ASSOCIATED WITH HIV-INFECTED AFRICAN WOMEN, LIKE A RELATIVE RISK OF 1.8 (95% CI 1.3 TO 2.6) IN SOUTH-AFRICA (STEIN ET AL, 2008).


SOCIO-ECONOMIC IMPACT OF CERVICAL CANCER

BECAUSE CERVICAL CANCER MAINLY AFFECTS WOMEN AT A RELATIVELY YOUNG AGE, THE SOCIO-ECONOMIC CONSEQUENCES ARE ENORMOUS. WOMEN IN SUB-SAHARAN AFRICA LOSE MORE YEARS OF LIFE TO CERVICAL CANCER THAN TO ANY OTHER TYPE OF CANCER. MANY WOMEN WITH CERVICAL CANCER CAN NO LONGER TAKE CARE OF THEIR FAMILY, AND THEIR DEATH LEAVES MANY ORPHANS. FROM THE GBD PROJECT DATA (FITZMAURICE ET AL, 2015), ONE CAN ESTIMATE THAT CERVICAL CANCER IN AFRICA LEADS TO THE LOSS OF 1510 DALYS (DISABILITY-ADJUSTED LIFE YEARS) PER MILLION WOMEN IN 2013, FOR 880 DALYS PER MILLION WOMEN IN THE REST OF THE WORLD.

MANAGEMENT OF PATIENTS WITH CERVICAL CANCER

THE MORTALITY TO INCIDENCE RATIO OF CERVICAL CANCER IN AFRICA IS HIGH, AROUND 66%, WHICH MEANS THAT TWO-THIRDS OF WOMEN WITH CERVICAL CANCER DIED FROM THE DISEASE. SEVERAL CAUSES CONVERGE TO THE HIGH FATALITY OF CERVICAL CANCER IN AFRICA (ANORLU, 2008):

• Most (about two thirds of cases) occur in areas where access to adapted anti-cancer treatment is rare
• Most cases are diagnosed at a late stage
• Poor nutritional status and anaemia (due to cancer bleeding)
• Frequent concomitant HIV infection
Condom use has never been popular in most African countries and factors influencing utilization patterns are unclear (Hearst et al, 2004). Intervention studies have revealed constant risk of HIV infection despite increased condom use (Kajubi et al, 2005). Distribution campaigns of condoms to men and to women, although massive in some countries (e.g., in South Africa), have not been sufficient for ensuring use during most events of sexual intercourse. Inconsistent (i.e., not at all high risk sexual intercourse) and incorrect (e.g., re-use of damaged condom) use of condom is common. In South Africa, the incidence of STIs and HIV infections remain very high despite apparent marked raises (57 to 87% in men and 46 to 73% in women 14-24 years of age) in the uptake of condom use signalled by population surveys done from 2002 to 2008 (Bekinska et al, 2012). Decreases in the use of condoms has been noticed after 2010 because the fear about HIV and AIDS epidemics were waning in the general population.

A main finding of studies was that circumcision and regular condom use were associated with reduced risk for oncogenic and overall HPV (Baldwin et al, 2004). Similar findings were observed for HIV. An ecological study of 118 developing countries showed that the higher the prevalence of male circumcision, the lower the incidence rates of cervical cancer and of HIV infection prevalence (Drain et al, 2006).

In view of these observations, three randomised trials were conducted between 2002 and 2006 in South Africa, Kenya and Uganda including men from the general population tested the hypothesis that circumcision could reduce the incidence of STIs. The three trials provided strong evidence that medical male circumcision reduces the acquisition of HIV by heterosexual men and a Cochrane review estimated that reductions of HIV transmission were between 38% and 66% over 24 months (Siegfried et al, 2009). One trial in Uganda found that male circumcision reduced by about 25% the incidence of oncogenic HPV infections in women (Wawer et al, 2011). In addition, male circumcision would reduce the incidence of other STIs in women (e.g., bacterial vaginosis and trichomoniasis). Circumcision of men when they are 20 to 30 years of age would be the most effective option (Londish et al, 2008).

The prevalence of male circumcision in less developed countries, especially in Africa has been the subject of scrutiny (Drain et al, 2006). It appears that circumcision rate are quite high in most Western and Northern countries, and uncommon in Eastern and Southern Africa (Figure 3). In the recent years, some countries have implemented ambitious large scale circumcision programmes, like in Rwanda where novel non-surgical modalities have been adopted for circumcising adult men (Mody et al, 2015; Mutabazi et al, 2014).

Figure 3: Male circumcision prevalence in Africa (figure created with data from Drain et al, 2006; separate data for Northern and Southern Sudan were not available)
In conclusion, male circumcision seems to represent a practical and affordable method for controlling the transmission of HIV, HPV and other STIs. Nonetheless, circumcision does not confer a complete protection against HIV and HPV transmission and this method needs to be supplemented with other prevention methods. The role of condom use and the effectiveness of projects promoting regular condom use is still debated.

Reproductive Factors

Family planning programmes intended to reduce women’s parity may contribute to reducing the HPV transmission (e.g., improving sexual hygiene, promoting regular use of condoms) and lower the duration of exposure of the cervical TZ to the vaginal cavity and thus to repeated HPV infections.

HPV Vaccination

The advent in the 2000s of prophylactic vaccines able to trigger immunity via the production of antibodies against certain types of HPV represents a considerable progress in the prevention of cervical cancer. There are at present three commercially available vaccines, a bivalent vaccine against HPV 16 and 18 (Cervarix® – approved in 2007), a quadrivalent vaccine against HPV 6,11,16,18 (Gardasil® – approved in 2006) and a nonavalent vaccine against HPV 6,11,16,18,31,33,45,52,58 (Gardasil 9®). In theory, approximately seventy per cent of cervical cancer cases could be prevented by vaccines against HPV 16 and 18 and 96% by the nonavalent vaccine (Arbyn et al, 2014a). Trials have shown that vaccines prepared against specific types have some capacity to protect against lesions caused by other strains (Malagon et al, 2012). Vaccination against HPV 6 and 11 also prevents genital warts. HPV vaccination in HIV+ subjects has been demonstrated to be safe and immunogenic. Efficacy results from ongoing trials are awaited for (Toft et al, 2014).

Considerable attention has been given to the safety of HPV vaccination. To date, no randomised trial or pharmaco-epidemiology study has reported side effects serious enough for questioning the large scale immunisation of young adolescents. Nation-wide studies that specifically examined the possibility of thrombo-embolic and neurologic adverse events (e.g., multiple sclerosis) found no increased risk associated with HPV vaccination (Anheim-Dahlstrom et al, 2013, Scheler et al, 2015). In 2014, the WHO has stated that the two commercially available HPV vaccine “continued to have an excellent safety profile” (World Health Organization, 2014a).

The immunogenecity and safety of HPV vaccines has also been studied in Africa and appears to be similar to studies done in other parts of the World, and the endemicity of malaria and of helminth infestation does not affect that immunogenecity (Nakalembe et al, 2015).

Anti-HPV vaccination is unable to eradicate present HPV infection (Hildesheim et al, 2007). Therefore, vaccination needs to be done preferentially before the start of sexual activity. In Africa, because a large proportion of women have their first sexual intercourse before age 15 years, HPV vaccination should start at around ten years of age (Sudenga et al, 2015). Large scale vaccination of young women and boys is likely to bring dramatic changes in the burden of cervical cancer in sub-Saharan Africa. Indeed, such vaccination represent an investment for the future given that at least twenty years would be needed before observing significant drops in the incidence of cervical cancer among younger women (i.e., women 20 to 40 years of age). However, HPV screening and vaccination of HPV-negative women is a new concept of integrated prevention that may accelerate changes in the burden of cervical cancer in sub-Saharan Africa. Indeed, such vaccination represents a considerable progress in the prevention of cervical cancer. There are at present three commercially available vaccines, a bivalent vaccine against HPV 16 and 18 (Cervarix® – approved in 2007), a quadrivalent vaccine against HPV 6,11,16,18 (Gardasil® – approved in 2006) and a nonavalent vaccine against HPV 6,11,16,18,31,33,45,52,58 (Gardasil 9®). In theory, approximately seventy per cent of cervical cancer cases could be prevented by vaccines against HPV 16 and 18 and 96% by the nonavalent vaccine (Arbyn et al, 2014a). Trials have shown that vaccines prepared against specific types have some capacity to protect against lesions caused by other strains (Malagon et al, 2012). Vaccination against HPV 6 and 11 also prevents genital warts. HPV vaccination in HIV+ subjects has been demonstrated to be safe and immunogenic. Efficacy results from ongoing trials are awaited for (Toft et al, 2014).

The trend is to incorporate HPV vaccines in national vaccination programmes. Uganda was the first sub-Saharan country to adopt national HPV vaccination in 2012. However the costs of these vaccines and their administration remain a serious barrier to the implementation of large scale vaccination campaigns in most African countries (Hutubessy et al, 2012). Furthermore, other diseases preventable through vaccination like gastro-enteritis due to the rotavirus, meningitis, and pneumonitis are competing for the same public money. One way to reduce costs is suggested by randomised trials that indicated that two doses instead of three doses of HPV vaccines had similar immunogenecity, and that different vaccine schedules did not affect immunogenecity (Lamontagne et al, 2013; LaMontagne et al, 2014). Reviews indicate that 2 doses of HPV vaccine in girls aged 9–14 years have immunogenecic properties comparable to when 3 doses are administered in girls of the same age group (World Health Organization, 2014a). A pooled analysis of two trials showed also protection against HPV16/18 infection (Kreimer et al, 2015).

In addition to cost issues, the vaccination of girls 9 to 12 years of age is challenging in view of the low attendance to schools in many areas. Other barriers include religious and cultural beliefs (Bello et al, 2011).

Worldwide health programmes like the Global Alliance for Vaccine Initiative (GAVI) have the necessary dimension for helping countries to introduce HPV vaccines in national programmes as well as for negotiating the price of vaccines. In 2013, the cost for one dose of HPV vaccine accessed through the GAVI programme was US$ 4.50, when such dose cost at least US$ 100 in developed countries (see www.gavi.org).

Despite the numerous economic and logistic barriers, a wealth of studies are on-going for determining best strategies for delivering HPV vaccination and for overcoming beliefs and cultural habits that could alter the feasibility and success of HPV vaccination programmes (Ezeanochie et al, 2014; Magusha et al, 2015; Poole et al, 2013). A major priority for Africa would be the demonstration of long-term protection of currently available HPV vaccines, allowing integration of HPV vaccination in the traditional expanded immunisations programmes targeting infants.

Socio-Economic Condition and Women’s Education

Improvements in socio-economic status, encouraging the education of women and the progress in the adoption of women’s rights may make a substantial contribution to cervical cancer prevention (and probably also other preventable conditions). The preventive properties of these actions are linked to the multiplicity of influences they exert on factors involved in cervical cancer occurrence. For instance, wealthier families tend to have less children. Educated women tend to adopt healthier behaviours like attending screening (when available). The defence of women’s rights may contribute in prioritizing the funding of cervical cancer screening and HPV vaccination campaigns.

Early Detection and Screening Programmes

Cytology

From 1970 onwards, cytology screening has been highly effective in reducing the incidence of and mortality from cervical cancer in developed countries (Arbyn et al, 2009; Cox et al, 1992; Watson et al, 2008). However cytology screening requires trained cytopsists, a high level of quality control, has to be repeated regularly and involves multiple patient contacts with health services for the detection, diagnosis and treatment of pre-cancerous lesions. For these reasons, cheaper screening methods, which are more adapted to low and middle income countries have been recently proposed and evaluated (Tsu et al, 2005).

Visual Inspection

Three randomised trials in India showed that naked eye visual inspection of the cervix after application of dilute acetic acid (VIA) can reduce the risk of being diagnosed with an advanced cervical cancer and the risk of cervical cancer death (Sankaranarayanan et al, 2007, Sankaranarayanan et al, 2013). Although VIA has not yet been widely adopted in Africa, it represents a considerable progress in the prevention of cervical cancer.
Swabbing the surface of the cervix with vinegar (i.e., 3-5 % aqueous solution of acetic acid) turns the neoplastic epithelium into a white area that keeps the whitening for at least one minute. This aceto-whitening may contain one or several pre-cancerous cervical lesion(s) that can be treated with cryotherapy (i.e., the so-called ‘see and treat strategy’). When inspection indicates the possible presence of an invasive cancer, the patient needs to be referred to a hospital for oncological treatment.

Although, VIA has been demonstrated to have good sensitivity and reasonable specificity for cervical pre-cancerous lesions in some studies (Sankaranarayanan et al, 2004), these findings could not be reproduced in other study settings (Zhao et al, 2010). In fact, it is increasingly clear that evaluation of VIA accuracy depends much on the experience of the assessor and on the type of gold standard test against which the VIA technique was evaluated (Arbyn et al, 2008).

The meta-analysis, in Figure 4, on the accuracy of VIA for CIN-2 or more lesions derived from studies with limited verification bias, obtained sensitivity estimates varying between 37% and 91% with an average value of 77%. Also the specificity for excluding presence of high-grade CIN was highly variable, between 49 and 98%. Visual inspection after application of lugol iodine (VILI): it is another visual inspection technique based on the principle that neoplastic tissues do not absorb the iodine and stay yellow. A large multi-centre large study, conducted in India and five African countries, showed that VILI is on average 10% more sensitive than VIA for CIN-2 lesions or worse without loss of specificity (Arbyn et al, 2008; Sankaranarayanan et al, 2004).

The detection of nucleic acid sequences of the genome of high-risk HPV types is another option for cervical cancer screening potentially applicable in Africa. Screening with clinically validated hrHPV assays, usually is very sensitive and shows a sensitivity (generally > 90% for CIN2+ and CIN3+) that is significantly greater than VIA and cytology (Arbyn et al, 2012; Cuzick et al, 2012). Nevertheless, the sensitivity of HPV testing was surprisingly low in ten studies conducted in low and middle income countries that compared HPV assays to VIA: the sensitivity could vary between 50% and 99%, with an average 82% (Figure 5). On the other hand, in ten Chinese studies, the sensitivity of hrHPV testing was uniformly very high (pooled value of 97%, p for inter-study heterogeneity=0.49, see figure 5). The lower sensitivity of HPV testing estimated in certain developing countries may be attributed to gold standard misclassification correlated with visual inspection findings (Arbyn et al, 2008), as shown in Figure 6). The higher efficacy of once-in-life time screening with HPV-testing compared to screening with cytology or VIA was evidenced in a large Indian randomised trial (Sankaranarayanan et al, 2009). In the HPV arm, the incidence of advanced cervical cancer (stage II+) was 53% (95% CI: 31-68%) lower and the cause-specific mortality was 48% lower (95% CI: 19-67%) compared to the women in the control arm where no screening was offered. No significant reductions were seen neither in the VIA nor cytology arms. Another advantage of HPV-based screening is that it can be performed on vaginal samples taken by the women herself (Arbyn et al, 2014b) and strategies based on HPV-testing in self-samples may increase population coverage rates (ArRossi et al, 2015; Verdoodt et al, 2015). About ten HPV assays are currently clinically validated for cervical cancer screening (Arbyn et al, 2015; Meijer et al, 2009). Given recent recommendations from USA, Australia, Europe and WHO, HPV will probably become the main test for cervical cancer screening world-wide. However, the challenge for Africa and other developing countries, is to identify an hrHPV assay that is clinically validated, low-cost, easy-to-use and adapted to the field circumstances prevailing in Africa, preferably in a point-of-care format and applicable on self-samples.
Chapter 10 - Africa: Cervical Cancer

Discussion on Cervical Cancer Screening

Cytology, VIA and HPV detection are the three methods currently recommended for secondary prevention of cervical cancer screening by the World Health Organization (2014b). But only the latter two (VIA and HPV testing) seem feasible for population-wide programmes in Africa. Decisions about whether to screen or not, and about the test to be used are to be taken by national health authorities on the basis of the burden of cervical cancer, the prevalence of other health conditions, and the available resources. It must be stressed that screening should only be offered when facilities for appropriate treatment of screen-detected cancer precursor lesions are made available to screened populations (World Health Organization, 2014b). Curative and palliative facilities in tertiary hospitals should be available for screen-detected cancer cases. VIA or VILI have the advantage of being cheap, simple tests that provide immediate results (allowing the implementation of “see-and-treat” strategies. Unfortunately, VIA and VILI have a variable accuracy which requires regular quality monitoring and training. HPV testing is highly sensitive and reliable but requires laboratory infrastructure and adequate logistics. Moreover, the tracking of women who tested positive for further management may be problematic. An interesting scheme is to screen with a point-of-care HPV test, followed by triage with VIA of hrHPV positive women and treatment of aceto-white lesions in one single visit. Use of a low-cost clinically validated HPV assay run in an equipped laboratory in urban areas with rapid transport communication and logistics might be a plausible alternative in the near future. Mechanisms to assure sufficient procurement in accurate screening tests for major target diseases at affordable prices, such as GAVI assures procurement of vaccines for developing countries, could become part of the agenda of international funding agencies. HPV vaccination of girls of 12-15 years combined with the screening of women aged 30-45 once-a-life-time might be an effective strategy that could reduce substantially the burden of cervical cancer in African countries.
Discussion and Conclusions
A key question is about the likely future burden of cervical cancer in sub-Saharan Africa.

Some scientists predict a nearly doubling of the number of cervical cancer cases from 2008 to 2030 on the basis that the prevalence of HIV and HPV infections are the highest in the world, combined with low access to HPV vaccination and screening, and also to population aging and growth (De Vuyt et al., 2013).

A current trend is to integrate sexual, reproductive health (SRH) and HIV policies, with the perspective that all these topics would be delivered by the same providers (Cooper et al., 2015). This integration could also encompass the prevention of cervical cancer, including screening. HPV vaccination is less amenable to integration because of age groups concerned (girls 9 to 12 years of age).

Challenges for research are the development and demonstration of effectiveness of a point of care HPV screening assay followed by triage by an accurate biomarker assay ensuring good specificity and pertinent lesional specificity. Such a combined test tandem should be made widely available.

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Chapter 11 – Kaposi’s Sarcoma

Kaposi’s Sarcoma: Uganda’s Experience

Solomon Kibudde, Annet Nakaganda, Jackson Orem

Kaposi’s Sarcoma is a multifocal angioproliferative disorder of vascular endothelium, primarily affecting mucocutaneous tissues with the potential to involve visceral organs. It is characterized by the development of multiple, usually asymptomatic, lesions on the skin and mucous membranes. The disease affects human immunodeficiency virus (HIV)-infected individuals, mainly those with advanced HIV disease, and is most common in regions with high HIV prevalence such as sub-Saharan Africa. In Uganda, Kaposi’s Sarcoma is the second most common cancer among HIV patients and is the third most common cancer seen in both men and women in Uganda (Ferlay et al., 2013). According to data from the Kyandondo cancer registry, in 2012 alone, the rate of new cases of Kaposi’s Sarcoma was 13.3% and mortality was 12%, with a 5-year prevalence of Kaposi’s Sarcoma at 12.2% (Ferlay et al., 2013). In Uganda, Kaposi’s Sarcoma is the second commonest cancer among HIV patients and it is the third commonest cancer seen in either men or women in Uganda (Ferlay et al., 2013).

In sub-Saharan Africa (SSA), Kaposi’s Sarcoma is endemic, and its incidence has increased substantially with the advent of the AIDS epidemic. In Uganda, Kaposi’s Sarcoma is the second commonest cancer among HIV patients and it is the third commonest cancer seen in either men or women in Uganda (Ferlay et al., 2013). According to data from the Kyandondo cancer registry, in 2012 alone, the rate of new cases of Kaposi’s Sarcoma was 13.3% and mortality was 12%, with a 5-year prevalence of Kaposi’s Sarcoma at 12.2% (Ferlay et al., 2013). In Uganda, despite of the observed decrease in HIV/AIDS prevalence since 1992, a decrease in Kaposi’s Sarcoma incidence was observed in only men-younger than 50 years but not in men aged > 50 years nor in women (Chabana et al., 2013). In a survey of over 12,600 participants of The AIDS Support Organization (TASO) in Uganda, the risk of developing Kaposi’s Sarcoma in the first 4-27 months after signing up with the non-governmental organization was increased significantly compared to the general population, with a standardized incidence ratio of 6 (95% CI (4.8, 8.4)) (Mubatule et al., 2006). While AIDS-associated Kaposi’s Sarcoma is the most common variant of Kaposi’s Sarcoma in Uganda, among the other forms of Kaposi’s Sarcoma, the African or endemic Kaposi’s Sarcoma is fairly common in clinical practice. The African or endemic Kaposi’s Sarcoma is a variant of disease affecting human immunodeficiency virus (HIV) –seronegative children and young adults in sub-Saharan Africa (Bunn et al., 2012, Deddie et al., 2003). The clinical course of endemic Kaposi’s Sarcoma is variable and individuals develop indolent skin lesions, locally infiltrative lesions of the extremities, and aggressive visceral involvement with potentially fatal sequel. Generalized lymphadenopathy is a common feature of endemic Kaposi’s Sarcoma (Hengge et al., 2002), and oral mucosa is infrequently affected (Bunn et al., 2012). In children with Kaposi’s Sarcoma, endemic forms are not uncommon in Uganda. The main presentation is of extensive lymph node involvement, with minimal cutaneous involvement.
Pathogenesis: What is the Role of Human Herpes Virus 8?

For decades, the aetiology and pathogenesis of Kaposi’s Sarcoma was unknown. Chang et al. (1994) reported the discovery of the Kaposi’s Sarcoma-associated herpes virus (KSHV), also known as human herpes virus-8 (HHV-8), and demonstrated an aetiological link between the virus and Kaposi's Sarcoma (Chang et al., 1994). HHV8 induces angiogenic and inflammatory cytokines, as well as gene products implicated in angiogenesis (Kang et al., 2008); and its viral load correlates with the clinical progression of Kaposi’s Sarcoma from patch/plaque to the nodular stage (Feller et al., 2008; Johnston et al., 2009; Chang et al., 1994; Hengge et al., 2002). HHV8 is also the aetiological agent for primary effusion lymphoma (PEL), and Multicentric Castleman disease (MCDI) (Baresova et al., 2013).

HHV infection further potentiates the development of Kaposi’s Sarcoma through the transactivation (Tat) protein, which acts as a growth factor for Kaposi’s Sarcoma (Guadalupe et al., 2011; Hasman et al., 2011). The Tat protein induces endothelial cell proliferation and facilitates the invasion of extracellular matrix (Hasman et al., 2011). Further on, there is a synergic relationship between the HIV and HHV8. HHV-8 infects the endothelial cells and increases its viral load by reactivating it from latent state (Guadalupe et al., 2011). HIV activation occurs with an increased HHV-1 Tat protein (Guadalupe et al., 2011), thus HIV and HHV-8 infection is associated with increased risk for Kaposi’s Sarcoma.

However, it is important to note that other factors play a role in the pathogenesis of Kaposi’s Sarcoma. This is supported by observations where the incidence of HHV-8 infection was only found in few cases (Okah et al., 1999). In addition, the regression of iatrogenic Kaposi’s Sarcoma with the cessation of immunosuppressive therapy indicates that HHV8 may be an essential but insufficient cofactor in the pathogenesis of Kaposi’s Sarcoma (Feller et al., 2006). For instance, gender plays a role in Kaposi’s Sarcoma; women tend to present with lower CD4 T-cell counts at diagnosis, frequent oral Kaposi’s Sarcoma, and were less likely to have tumour-associated oedema or nodular lesions than men (Phipps et al., 2010). In HIV-seropositive patients, the presence of HHV8 DNA in peripheral blood had been shown to predict the onset of Kaposi’s Sarcoma (Cannon et al., 2003; Johnston et al., 2009; Whitty et al., 1993). It is postulated that HHV8-mediated immune suppression/ deregulation promotes T-helper type-1 cytokines, such as TNF-alpha, interleukin-1b (IL-b), and IL-6 (Feller et al., 2008; Krown, 2003; Papagatsia et al., 2009).

Clinical Presentation

Nearly all patients with Kaposi’s Sarcoma present with a lesion in the oral cavity; however, oral lesions are more frequent in the epidemic variant of the disease (Bottler et al., 2007; Dreyer et al., 2009; Lager et al., 2003; Lebbé et al, 2008; Mohanna et al., 2007; Mwakigonja et al., 2007). The oral cavity is the first clinical site of disease in 22% of patients with Kaposi’s Sarcoma (Picca et al., 1988; Flati et al., 1997; Lager et al., 2003; Mohanna et al., 2007) and up to 71% of HIV patients may have concurrent cutaneous and visceral involvement (Lager et al., 2003; Mohanna et al., 2007). Lesions of AIDS-Kaposi’s Sarcoma tend to enlarge, multiply in number, become more nodular, or coalesce in association with immune deterioration (Pettit et al., 1986). Epidemic Kaposi’s Sarcoma presents as multifocal plaques, patches, and nodules with a predilection for the face and lower extremities (Figure 2 and 3; Henderson, 2009; Lynen et al., 2005; Vanni et al., 2006). The lesions should be evaluated for the number, nodularity, size, the diameter, location, and presence of oedema.

Cutaneous Kaposi’s Sarcoma is frequent in patients with Kaposi’s Sarcoma; however, its absence does not exclude visceral Kaposi’s Sarcoma. A wide spectrum of lesions is seen in patients with AIDS-Kaposi’s Sarcoma, often in the setting of advanced immunosuppression (Vanni et al., 2006). Lesions of AIDS-Kaposi’s Sarcoma tend to enlarge, multiply in number, become more nodular, or coalesce in association with immune deterioration (Pettit et al., 1986). Epidemic Kaposi’s Sarcoma presents as multifocal plaques, patches, and nodules with a predilection for the face and lower extremities (Figure 2 and 3; Henderson, 2009; Lynen et al., 2005; Vanni et al., 2006). The lesions should be evaluated for the number, nodularity, size, the diameter, location, and presence of oedema.

The presence of tumour-associated oedema, its locations and severity should be documented. Oedema signifies advanced disease and this constitute a criterion for the high risk group for both relapse and poor response to treatment. Some patients present with gross oedema of the lower limbs mimicking other tropical diseases like filariasis, elephantiasis and lymphedema.

More than 50% of patients with AIDS-Kaposi’s Sarcoma may have visceral involvement (Marteltotta et al., 2009). Gastrointestinal Kaposi’s Sarcoma manifests as abdominal pain, diarrhoea, weight loss, bleeding and vomiting (Lynen et al., 2005; Marteltotta et al., 2009). Pulmonary Kaposi’s Sarcoma manifests as cough, dyspnoea, chest pain and haemoptysis. The radiological findings of pulmonary Kaposi’s Sarcoma on chest x ray include pleural effusion, the “ground glass appearance” or the “cotton-wool appearance” of the lung parenchyma, and hilar adenopathy, as shown in Figure 4 (Henderson, 2009; Papagatsia et al., 2009). In paediatric Kaposi’s Sarcoma, over 50% patients present with lymph node involvement, followed by cutaneous involvement and visceral involvement in that order (Gannt, 2008).
Prognosis
The AIDS Clinical Trial Group (ACTG) classification was developed in the pre-HAART era to predict survival for patients with AIDS-associated Kaposis Sarcoma. The criteria is defined using the tumour (T), immune system (I) and systemic illness (S) (Krown et al, 1997) as shown in table 1. Tumour is defined as T0 if disease is confined to the hard palate, or T1 if there is pulmonary or gastrointestinal involvement, tumour associated oedema or ulceration, or extensive oral involvement. Patients with the combination of poor stage (e.g. tumour-associated oedema) and constitutional symptoms (T1S1) were found to have an unfavourable prognosis (Okuku et al, 2012) with a 3-year survival rate of 53% (Nasti et al, 2003). In contrast, HIV patients on HAART with none or only 1 prognostic criteria (T0S0, T0S1, T1S1), were found to have a good prognosis with a 3-year survival rate of 88%, 80%, and 81%, respectively (Nasti et al, 2003). Other prognostic factors include; number of Kaposis Sarcoma containing anatomic sites, and haemoglobin (Okuku et al, 2012).

Table 1: AIDS Clinical Trial Group classification criteria for Kaposis Sarcoma

<table>
<thead>
<tr>
<th>Good prognosis</th>
<th>Poor prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T – Tumour extent</strong></td>
<td><strong>Poor prognosis</strong></td>
</tr>
<tr>
<td>Localized lesions</td>
<td>Ulcerated lesions</td>
</tr>
<tr>
<td>Uninfiltrative</td>
<td>Ulcerative</td>
</tr>
<tr>
<td>Minimal nodular disease</td>
<td>Ulcerative</td>
</tr>
<tr>
<td><strong>I – Immunosuppression</strong></td>
<td><strong>Infiltrative</strong></td>
</tr>
<tr>
<td>CD4 &gt; 200 cells/µl</td>
<td>CD4 &lt; 200 cells/µl</td>
</tr>
<tr>
<td>CD4 &gt; 50%</td>
<td>CD4 &lt; 50%</td>
</tr>
<tr>
<td>No lymphadenopathy</td>
<td>Pre-skin nodular</td>
</tr>
<tr>
<td><strong>S – Severity systemic illness</strong></td>
<td><strong>Swollen lymph nodes</strong></td>
</tr>
<tr>
<td>Karnofsky score &gt; 70%</td>
<td>Karnofsky score &lt; 70%</td>
</tr>
<tr>
<td>No opportunistic infections</td>
<td>Opportunistic infections</td>
</tr>
<tr>
<td>No AIDS defining illnesses</td>
<td>Oral candidiasis</td>
</tr>
<tr>
<td>No oral candidiasis</td>
<td>No oral candidiasis</td>
</tr>
</tbody>
</table>

In contrast to AIDS-Kaposis Sarcoma, classic and endemic Kaposis Sarcoma do not have a universally accepted staging classification. The most widely used criteria was proposed by Brambilla et al, 2002; the classification is composed of four stages based on cutaneous lesions: location, presence or absence of complications and visceral involvement as shown in Table 2 (Brambilla et al, 2003).

Table 2: Staging of Classic Kaposis Sarcoma

<table>
<thead>
<tr>
<th>Stage</th>
<th>Cutaneous lesions</th>
<th>Location</th>
<th>Behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Macular or nodular</td>
<td>Lower limbs</td>
<td>Non-aggressive</td>
</tr>
<tr>
<td></td>
<td>- Plaques</td>
<td>Lower limbs</td>
<td>Locally aggressive</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>Edematous plaques and papules</td>
<td>Intermittent, particularly the lower limbs</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>Ulcerated plaques and papules</td>
<td>Extensive, facial, genital</td>
</tr>
</tbody>
</table>

Diagnosis
The most common differential diagnosis of cutaneous Kaposis Sarcoma lesions in Uganda is bacillary angiomatosis; hence histological tissue evaluation is important for definitive diagnosis (Mohanna et al, 2007). The microscopic features include an abundance of proliferating mononuclear inflammatory and spindle cells, ill-defined vascular channels, haemorrhage, and oedema (Dreyer et al, 2009; Kang et al, 2008).

The clinical and microscopic features of Kaposis Sarcoma mimic the clinical and microscopic features of bacillary angiomatosis (BA) caused by Bartonella henselae (Lynen et al, 2005), and therefore additional test to identify HHV8 DNA improves the quality the diagnosis (Feller et al, 2007; Hammock et al, 2005).

The diagnosis of Kaposis Sarcoma mandates evaluation for the presence of co-existing HIV. The HIV sero-positive patient requires a detailed history about the HIV infection including duration since diagnosis, opportunistic infections, nadir and current CD4-T cell counts, HAART regimen and its durations, and the response of the skin lesions to the HAART. Initial workup for staging AIDS-associated Kaposis Sarcoma involves a complete physical examination that includes evaluation of skin, oral cavity, and rectum, a chest x-ray, an abdominal ultrasound scan, a stool faecal occult blood test, a CD4 T-cell count, complete blood count, liver function tests and renal function tests. When pulmonary or gastrointestinal disease is suspected, lesions may be visualized by bronchoscopy or endoscopy, respectively (Vanni et al, 2006).
Treatment

Currently, Kaposi's Sarcoma has no cure. The goals of treatment are to control disease symptoms and prolong life, and therapy is tailored to the clinical variant of Kaposi's Sarcoma and disease stage. The majority of patients with Kaposi's Sarcoma in Uganda present with advanced stage of the disease, and hence the aim of treatment is to control symptoms, palliate pain and improve quality of life. All patients with AIDS-associated Kaposi's Sarcoma should initiate HAART as soon as the diagnosis is made, regardless of the CD4 T-cell counts. Treatment with HAART may induce complete remission in patients with good immunological response and limited disease (Bassett et al., 1995, Martellotta et al., 2009). The patients with T1 disease with a performance status ≥ 40%, adequate bone marrow function, renal, and hepatic function tests should be given concurrent systemic chemotherapy and this will reduce morbidity through alleviating the pain, oedema, lymphadenopathy and skin lesions, and slowing the progression of systemic disease. In Uganda, our preferred first line chemotherapy is a combination of Bleomycin and Vincristine, given every three (3) weeks for six to nine cycles to achieve very good partial response or clinical remission. In contrast, liposomal doxorubicin is the preferred first-line regimen for AIDS-associated Kaposi's Sarcoma in high income countries due to its higher efficacy and reduced toxicity (Cooley et al., 2007; Samad et al., 2007), but the cost and access are limiting factors in Uganda.

In patients with localized disease, localized treatment modalities are recommended and these include radiotherapy and topical therapy with alitretinoin gel or imiquimod gel. Other local therapies like cryotherapy, laser therapy, and intra-lesion interferons are not readily available in a country such as Uganda.

Following systemic chemotherapy, Kaposi’s Sarcoma patients are reviewed monthly for three months and thereafter every three months for six months, then bi-annually for one year and annually for life. At every visit, the clinician should take record of the lesions: size, number, location, characteristics, severity of oedema and location of tumour-associated oedema, and number of raised and flat lesions. The clinical features of lesions, such as colour, surface, and presence of nodularity should also be documented (Tones et al., 2006). Radiological and other imaging or endoscopic investigations should be requested in patients with suspected non-measurable lesions including ascites, pleural and pericardial fluid, lymphatic lung disease, and abdominal masses/abdominal organomegaly.

Table 3: Systemic chemotherapy for patients with Kaposi’s Sarcoma in Uganda

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Drug</th>
<th>Dosage</th>
<th>Route/Time</th>
<th>Frequency/Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>First line treatment</td>
<td>Bleomycin sulfate</td>
<td>25 mg/m² as a 5 minute IV push</td>
<td>every 3 weeks</td>
<td>up to 9 cycles</td>
</tr>
<tr>
<td>First line treatment</td>
<td>Vincristine sulfate</td>
<td>1.5 mg/m² as an IV push</td>
<td>every 3 weeks</td>
<td>up to 9 cycles</td>
</tr>
<tr>
<td>Second line treatment</td>
<td>Paclitaxel</td>
<td>150 mg/m² as a 3 hour IV infusion</td>
<td>once every 3 weeks</td>
<td>up to 12 cycles</td>
</tr>
</tbody>
</table>

Response evaluation in patients with AIDS-Kaposi's Sarcoma is guided by the ACTG criteria where; complete response (CR) is defined as ≥ 50% decrease in the number or size of previously existing evaluable lesions lasting for at least four weeks without the appearance of new lesions or tumour-associated oedema. Stable Disease (SD) is defined as any response that does not meet the criteria for progression or CR. Partial response (PR) is defined as a 25% decrease in the number or size of previously existing evaluable lesions lasting for at least four weeks without the appearance of new lesions or tumour-associated oedema. Stable Disease (SD) is defined as any response that does not meet the criteria for progression or CR. Overall response rate is defined as both complete and partial rates. Progressive Disease (PD) is defined as a ≥ 25% increase in the size of previously existing lesions or the appearance of new ones or the development of new or increasing tumour-associated oedema or infiltration. Relapse is defined as the development of progressive disease in the presence of a documented CR, or PR.

Conclusions

Kaposi's Sarcoma is a vascular tumour of endothelial origin that is associated with HHV-8 infection. In sub-Saharan Africa, AIDS-Kaposi’s Sarcoma remains the most common HIV-associated malignancy and hence it poses a huge burden to the already constrained health-care systems. Kaposi's Sarcoma has four clinical variants: classic, endemic, iatrogenic, and epidermic Kaposi's Sarcoma. The histopathology in these different Kaposi's Sarcoma forms is essentially identical, however they differ in their HHV-8 DNA identification in tissue. Our findings help confirm the diagnosis and distinguishes Kaposi’s Sarcoma from its mimics. Even though, there is no cure at present, the expanding knowledge of Kaposi's Sarcoma biology increases hope for rational therapies and hence better quality of life among patients with Kaposi's Sarcoma.

References


Chapter 12

Africa: Breast Cancer

Breast Cancer in Africa: Screening, Diagnosis and Treatment

Catherine Duggan, John R. Scheel, Benjamin O. Anderson


The continent of Africa is made up of 55 states, the majority of which are classified as Low- and Middle-Income Countries (LMICs) (The World Bank, 2015). Forty-eight are categorized as sub-Saharan, and the remaining seven are in North Africa. These countries are linguistically, culturally, demographically and ethnically diverse. Unfortunately, one area of commonality shared by African women regardless of their nationality is poor outcomes from breast cancer with associated high mortality rates. The recent CONCORD-2 study of 5 year breast cancer survival rates from 1995-2009 based on the analysis of individual data from 279 population-based registries in 67 countries, reported that in High Income Countries (HICs) age-standardized net-survival rates were in excess of 85% (Allemani et al, 2015). One country in Africa, Mauritius, a HIC island nation off the coast of Madagascar, had similar 5-year survival rates of 87.4 (78.1–96.7) and North African countries had somewhat less favourable outcomes including 59.8 (48.6–71.1) in Algeria; 76.6 (55.5–97.7) in Libya (Benghazi registry); and 68.4 (64.5–72.2) in Tunisia. By contrast, data are available from only 2 sub-Saharan African countries: South Africa, 53.4 (35.5–71.3); and Mali, 13.6 (0.0–30.1) both of which are significantly inferior to other regions around the world (Allemani et al, 2015).

The reasons for these disparities are varied. Cancer remains a low priority for much of the population in Africa, with many barriers impeding women’s access to affordable effective breast health care, including gaps in the receipt of accurate, culturally appropriate information on breast health including signs and symptoms of breast cancer; access to breast cancer early detection and to appropriate and timely diagnosis and treatment. These barriers can be cross-cultural such as endemic poverty, a lack of infrastructure, inadequate training and expertise, inequitable distribution of services in urban vs. rural areas, and poverty (Harford, 2015). Barriers, which are rarely encountered in HICS such as major transportation deficits, are common in Africa. A study in the Republic of South Africa reported that increasing residential distance from hospitals was associated with risk of late stage diagnosis (Dixons et al, 2014), and a study in Cameroon reported that 29% of patients seen over 2 months in 2010, travelled for more than 7 hours to reach the hospital to receive treatment for cancer (Price et al, 2012). Unfortunately, many countries in the region also have a history of military conflict and political instability which contribute to fragmented health infrastructure, and often disrupt established health care practices (Spiegel et al, 2014). Finally, other more culturally specific barriers also limit women’s ability to seek care even...
where it is available and include such as sociocultural influences as use of traditional medicines, discrimination, stigma, and cultural taboos, along with fears of mastectomy and of abandonment after a diagnosis of breast cancer (Daher, 2012; Nour, 2003). For example, a Nigerian study of 2154 breast cancer patients where 87% presented with stage III or IV disease reported that the most common reasons for delay in seeking treatment were preference for prayer houses or spiritual healing homes (13.9% of patients); a belief that the lesion was due to inflammation (9.8%); preference for native doctors or herbalists (23.1%) and economic reasons (10.2%)(Ajekigbe, 1991). A Rwandan report of 144 breast cancer patients seen at rural hospitals, reported that seeing a traditional healer first were significantly associated with a longer delay in seeking treatment, a risk factor for late stage diagnosis (Pace et al, 2015).

Investment in healthcare overall in the region is limited. Total expenditure on health per capita (US$) in 2013 in countries classified by the World Bank as low income averaged US$36, compared to US$77 in middle-income countries, and US$687 in HIC (Table 1). The World Bank, 2015). Competing burdens of communicable diseases, and high child and maternal mortality rates, make it difficult for many countries to prioritize health spending on cancer, especially as rates of cancer have historically been lower than in HICs(Galiakinde et al, 2010). Despite the increase in breast cancer incidence and the concomitant increase in breast-cancer related mortality, spending on all cancers averaged only 5% of the total health spending on cancer, especially as rates of cancer have historically been lower than in HICs (Galukande et al, 2010). Despite the increase in breast cancer incidence and the concomitant increase in breast-cancer related mortality, spending on all cancers averaged only 5% of the total health spending on cancer, especially as rates of cancer have historically been lower than in HICs (Galukande et al, 2010).

Table 1: Characteristics of North African and Sub-Saharan countries

<table>
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<tbody>
<tr>
<td>Algeria</td>
<td>North Africa</td>
<td>Low income</td>
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<td>18</td>
<td>28</td>
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</tr>
<tr>
<td>Anglo</td>
<td>Sub-Saharan Africa</td>
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<td>363.22</td>
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<td>12</td>
<td>5</td>
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<td>Sub-Saharan Africa</td>
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<td>38.68</td>
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<td>Congo</td>
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<td>87.17</td>
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<td>Democratic Republic of Congo</td>
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<td>Djibouti</td>
<td>Sub-Saharan Africa</td>
<td>Low income</td>
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<td>Egypt</td>
<td>North Africa</td>
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<td>19.63</td>
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<td>Low income</td>
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<td>18</td>
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<td>Equatorial Guinea</td>
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Statistics:
Breast cancer is the second most common cancer worldwide, and the most common cancer in women (1.7 million cases, 11.9% of total cases); incidence rates vary nearly fourfold across the world regions, with rates ranging from 27 per 100,000 in Central Africa to 96 in Western Europe (Ferlay et al, 2015). However, it is the most frequent cause of cancer death in women in LMICs (324,000 deaths, 14.3% of total deaths).

While breast cancer incidence is lower in LMICs, its incidence is increasing rapidly compared with HIC, where rates have been stable or have declined since the early 2000s. Between 1990 and 2013, age-standardized incidence rates (ASIR) per 100,000 have increased by 17% globally (44.36 to 51.73), by 46% in developing countries (27.74 to 40.40) and by 8% in developed countries (89.75 to 74.98) (Fitzmaurice et al, 2015). For breast cancer in 2012, Globocan reported that more cases occurred in less developed (883,000 cases) than more developed regions (749,000) (Ferlay et al, 2015). In addition, the burden of breast cancer is greater in LMICs: breast cancer caused 13.1 million disability-adjusted life-years (DALYs) in 2013, 63% occurred in developing countries and 37% in developed countries (Fitzmaurice et al, 2015).

Similar to other countries with previously low incidence rates of breast cancer, incidence rates of, and mortality from breast cancer are rapidly increasing in the Arab countries in North Africa (Libya, Tunisia, Morocco, Algeria and Mauritania). Breast cancer in Arab women is often diagnosed at a younger age and at a more advanced stage (El Saghir et al, 2006; El Saghir et al, 2002; Ezziat et al, 1999; Salhia et al, 2011) compared to other populations. The ASIR of breast cancer in North Africa for example is currently 2-4 times lower than in western countries (Corbex et al, 2014) but is expected to double in the next 15 years as risk factor exposure increases (including that related to population ageing).

In sub-Saharan Africa, the proportion of the disease burden attributable to cancer is rising, and the region is projected to have more than an 85% increase in cancer incidence by 2030, solely based on demographic changes (i.e., a larger and older population than exists presently) (Mariapan-Bello et al, 2013). Unfortunately, the overall case fatality from breast cancer, as estimated by the ratio of mortality to incidence (MMR) in a given region or country, is consistently higher in LMICs (Table 2) (Ferlay et al, 2015; Ferlay et al, 2013). Overall cancer mortality in sub-Saharan Africa is high because of poor infrastructure, insufficient numbers of health-care workers, advanced stage at presentation, reliance on traditional therapeutics, few treatment choices, and poor compliance with treatment regimens (Kingham et al, 2013).

Table 2: Estimated cumulative risk to age 75 (percent) for Incidence and Mortality* by region. North America and Europe are included for comparative purposes.


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<th>Mortality (%)</th>
<th>MRR</th>
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Late Stage Diagnosis

Late stage diagnosis is a principal barrier to improving outcomes in women with breast cancer in LMICs. Down staging of disease is one of the more important strategies in areas where limited treatment will have the most chance of success. However the women in this region with symptoms of breast cancer do not seek medical attention, leading to late stage presentations, and poor prognosis. Barriers to reducing stage at diagnosis include lack of screening and early detection services, poverty, limited awareness of early signs and symptoms of cancer among both the public and health care providers, reliance on traditional beliefs and treatments, and stigma associated with a diagnosis of cancer (Daher, 2012; Keusch et al, 2006).

Delayed presentation is common: for example one study reported a mean delay of 11.2 months between the onset of symptoms and presentation in Nigerian women diagnosed between 1996 and 2003, (Adesunkanmi et al, 2006) and a second study found that 67% of women waited more than 3 months after symptoms appeared before seeking treatment (Adisa et al, 2011). A study of 66 Ghanaian patients with breast cancer found that while 14 (21.2%) of the breast cancers were discovered through breast education and clinical breast examination (CBE) as offered through outreach programs, women commonly waited between 6 weeks to 2 years before seeking formal diagnosis and treatment (Uggo, Lampetry et al, 2009). Two Cameroonian studies found significant delays in seeking care: one study examined 531 women seen over a 10 year period, and found that the mean delay before presentation at hospital was 10.4 months, and 54.9% had used traditional medicine before medical evaluation. Metastasis and locally advanced breast cancer at diagnosis were present in 8.1% and 62.8%, respectively (Kemfong Nghova et al, 2011b). A second study reported that 35% percent of patients waited >6 months to speak to a health care provider after the first sign of their cancer (Price et al, 2012). A report of 200 Libyan women diagnosed between breast cancer 2008 and 2009 found that 56% were diagnosed within a period more than 6 months after presentation of symptoms (Bimish et al, 2012). One hundred and forty-four breast cancer patients in 2 hospital in Rwanda had a median total delay between symptoms presentation and treatment of 15 months, resulting from a combination of both patient delays in seeking treatment, and health system delays (both a median of 5 months); patient and system delays of >6 months were significantly associated with diagnosis at more advanced stages (Pace et al, 2015). Finally, an Ethiopian study of 82 newly diagnosed breast cancer patients, reported that more than 60% presented after >2 years following onset of symptoms, and 66% of patients had late stage disease (Tesfamariam et al, 2013). These delays in seeking care result in diagnosis at a more advanced stage compared to other populations.

The African Cancer Registry Network (AFCRN) encourages registries to record stage at diagnosis, although a recent review found that less than half were recording TNM status (Gakunga et al, 2015). Thus, the majority of reports at the present come from retrospective reviews of breast cancer patients and not for mammographic screening (Anderson et al, 2008; Anderson et al, 2011; Smith et al, 2006).

With a history of profound lack of investment in breast health care, the question of ‘where to start’ is difficult to answer. However a number of African countries in partnership with international agencies are making significant strides in improving components of breast health care. In addition, tools such as the Breast Health Global Initiative (BHGI) evidence-based, economically feasible, and culturally appropriate guidelines for breast health care can allow countries to implement programs that are most appropriate to their resource level. These guidelines were developed according to a 4-tiered system, depending on the availability of resources, and classified as ‘basic’, ‘limited’, ‘enhanced’ and ‘maximal’ levels services. For example, for early detection programs, basic level services are appropriate where mammography services are unlikely to be available, and encompass breast health awareness campaigns emphasize obtaining a history of symptoms suggestive of breast cancer and CBE in women who seek medical care. Limited level services are intended for areas with resources for diagnostic imaging, such as ultrasound and mammography, but not for mammographic screening (Anderson et al, 2008; Anderson et al, 2011; Smith et al, 2006).

The International Atomic Energy Agency (IAEA) Program for Action for Cancer Therapy (PACT) carries out comprehensive cancer control capacity plan to allocate resources to all cancer care components (including radiation therapy) at eleven provincial hospitals and one centre of excellence (IAEA, 2015b).

Infrastructure

Cancer care in any country is a costly, complex and multi-step endeavour, particularly for breast cancer, a heterogeneous disease, where effective treatment is dependent on early detection and diagnosis. Given that the majority of African countries spend less than 6% of their GNP on all healthcare, which also must cover communicable diseases, the scale of the problem can be overwhelming (Strother et al, 2013). While some middle income African countries, such as South Africa and Ghana have several cancer centres, others have none (Stefan et al, 2013; Stulac et al, 2013). Among existing facilities, there are a lack of trained personnel and technology. For example, a 2013 review of teletherapy units in Africa found that the average number of units was 0.22 per million people in sub-Saharan Africa, with the majority being located in urban referral hospitals. Many African countries have no radiotherapy machines at all (Abdel-Wahab et al, 2013).

With a history of profound lack of investment in breast health care, the question of ‘where to start’ is difficult to answer. However a number of African countries in partnership with international agencies are making significant strides in improving components of breast health care. In addition, tools such as the Breast Health Global Initiative (BHGI) evidence-based, economically feasible, and culturally appropriate guidelines for breast health care can allow countries to implement programs that are most appropriate to their resource level. These guidelines were developed according to a 4-tiered system, depending on the availability of resources, and classified as ‘basic’, ‘limited’, ‘enhanced’ and ‘maximal’ levels services. For example, for early detection programs, basic level services are appropriate where mammography services are unlikely to be available, and encompass breast health awareness campaigns emphasize obtaining a history of symptoms suggestive of breast cancer and CBE in women who seek medical care. Limited level services are intended for areas with resources for diagnostic imaging, such as ultrasound and mammography, but not for mammographic screening (Anderson et al, 2008; Anderson et al, 2011; Smith et al, 2006).

The International Atomic Energy Agency (IAEA) Program for Action for Cancer Therapy (PACT) carries out comprehensive cancer control capacity plan to allocate resources to all cancer care components (including radiation therapy) at eleven provincial hospitals and one centre of excellence (IAEA, 2015b).
A critical barrier to providing cancer care in LMICs is the profound shortage of health professionals. According to WHO, 97 countries worldwide including 36 in sub-Saharan Africa, are experiencing a critical shortage of health professionals including surgeons, radiologists, nurses and oncologists (IAEA, 2015b; Kingham et al, 2013; Stulac et al, 2015). In order to achieve sustainable breast cancer control capacity in developing countries, and in Africa in particular, a large increase in professionals trained locally or regionally is needed. IAEA-PACT has called for measures to strengthen local recruitment and ensure retention of graduates from national training programs, and is currently supporting Virtual University for Cancer Control network (VUCNet) and the Regional African Cancer Training Network (RACT). A training program on-site at several cancer centers in sub-Saharan Africa, in collaboration with WHO, IARC, the Union for International Cancer Control (UICC), the United States National Cancer Institute (US NC), the African Organization for Research and Training in Cancer (AORTC), and with private sector funding from Roche (IAEA, 2015a; IARC, 2015a; VUCNet and RACT are part of the EDUCARE Education for Cancer in Africa program). Initiative. Ghana, Uganda, United Republic of Tanzania and Zambia comprise the initial intervention countries with South Africa and Egypt acting as mentor countries (IEA, 2015b). In 2010 PACT and BHGI developed an initiative in Ghana to implement a learning lab with a focus on breast cancer control, using the VUCNet platform (IAEA, 2015a).

Policy: Cancer Control Plans

The World Health Organization developed guidelines for regional and national cancer control programs stratified by national economic development. The WHO recommends cancer control programs in Africa begin in a stepwise approach by implementing one or two key priorities in a demonstration project. The WHO stated that projects could be sustainable only when African countries take the initiative and make the political commitment to invest in the programs with a dedicated budget and required staff (World Health Organization, 2005). A 2013 WHO survey assessing non-communicable disease (NCD) capacity found that of 55 African countries, only 16 had an operational policy/strategy/action plan for cancer (World Health Organization, 2015a). While some countries lack specific policy program or plan for the prevention or control of breast cancer (WHO, African Health Observatory, 2014), some are attempting to implement a variety of interventions including free health care initiatives, and some have described specific programs from breast cancer control. Country specific examples of breast cancer early detection status include the following:

- In Kenya, a report by the Kenyan Ministry of Health called for enhanced health promotion and education, and to improve early detection of cancer by introducing or expanding screening programs, and by developing guidelines for screening and early detection of cancer (Ministry of Public Health and Sanitation and the Ministry of Medical Services, 2012). However, many of these have yet to be implemented (Mathéka, 2014). No formal guidelines for breast screening for the country are currently available.

- In Malawi, mammographic screening is available in only one private hospital (Msambaza et al, 2012) and there are no governmental guidelines on breast cancer screening.

- The Republic of Mauritius developed a National Cancer Control Program for 2010-2014, and recommended that breast health awareness campaigns encouraging BSE and yearly CBE to women >40 years. Population-based screening mammography was not thought to be advisable, given the relatively high proportion of cancers in women younger than 45 years (Republic of Mauritius, 2014).

- There are no formal screening guidelines in Zimbabwe, but a number of non-profit organizations such as the Cancer Association of Zimbabwe and Breast Cancer Association of Zimbabwe recommend breast health awareness and regular BSE (The Cancer Association of Zimbabwe, 2014). A recent report by the Zimbabwean Ministry of Health on a strategy setting out national goals for cancer prevention and control from 2012-2018 identified a series of barriers to breast and other cancers screening. These included lack of access to early detection, inadequate resources, equipment and technology, lack of education and awareness of the importance of regular cancer screening, prohibitive costs of screening services, and lack of referral of patients. The goals of this strategy included a reduction of late stage breast cancer presentation from 65% to 50% by 2018 (Ministry of Health and Child Care, Zimbabwe, 2013).

- Since 2011, Rwanda has been proactive in developing a national cancer program (Stulac et al, 2015). The national cancer plan was developed by a technical working group of clinicians, civil society representatives, NGOs and international partners to create a program integrating components of the WHO National Cancer Control Plan framework while incorporating experiences of partners from South Africa, the U.S. and Europe. The first national cancer control protocols were first endorsed in 2012 and provide guiding principles on cancer diagnosis and treatment at the Butaro Cancer Center of Excellence (BCCOE), which is the first rural cancer center to deliver comprehensive cancer services in the country through a decentralized health system that prioritizes equitable access to all levels of care. BCCOE was created and is supported through a unique twinning partnership between the Rwandan Ministry of Health (MOH), the NGO Partners in Health and Harvard Medical School. While no breast screening program has yet been instituted, the MOH has supported education of community health workers in supportive care and provided information to women to support breast health awareness. The feasibility screening with the use of CBE at initial point of contact has been evaluated as a national initiative at the request of the MOH (Abdala et al, 2013), but the program has not yet been implemented.

- In Egypt, cancer has become a national priority with the publication of the 2014-20 national cancer plan (Nabil et al, 2014), but it is unclear whether any progress has been made. No data on breast screening policies or practices are published.

Pathology

Accurate diagnosis is a cornerstone of effective breast cancer control. BHGI guidelines emphasized the importance of a pathologic diagnosis before initiation of treatment (Shyam et al, 2006; Shyam et al, 2010). However, the process is complex and requires specialized training correct tissue preparation and consensus diagnoses. The capacity and infrastructure necessary to perform adequate pathological assessment of breast cancers is lacking in the majority of African countries. A recent informal survey which aimed to capture the number of pathologists working in African countries reported that, with the exceptions of Botswana and South Africa, all countries in the region have fewer than one pathologist (including all practice sub disciplines) for every 500,000 people, with many having fewer than one per million. One country (Somalia) did not have any active pathologists (Table 1) (Adesina et al, 2013; Awadekarim et al, 2010). Adesina et al recommended 3 necessary components to ensure provision of effective pathological services including meeting system needs, quality assurance needs and workforce needs (Adesina et al, 2013; Adesina et al, 2011).

A major limitation to breast cancer care in sub-Saharan Africa is the shortage of pathologists, resources and infrastructure. BHGI guidelines stratified diagnostic and pathology methods into basic, limited, enhanced, and maximal. Minimal requirements at the basic level include obtaining a medical history from patients, performing a CBE, a tissue diagnosis, and maintaining high quality medical records. The latter is not an insignificant issue: a Cameroonian retrospective study of 531 patients with breast cancer reported that 33% of medical files were incomplete, or missing, and stated that the ‘problem of medical records is a big concern in developing countries, and it represents a major handicap for medical statistics and research in this setting’ (Kemfanga Ngwa et al, 2011b).

At the limited level, with increasing availability of resources, several approaches are proposed for improving breast pathology, including training pathologists, establishing pathology services in centralized facilities, and organizing international pathology services (Shyam et al, 2006). The importance of the development of optimal breast pathology services has been identified by the BHG as a fundamental requirement for the
delivery of quality breast oncology with an emphasis on patient outcome (Masood et al, 2008). Immunohistochemical marker assessment is necessary to determine oestrogen receptor (ER) status, but the resources needed are beyond the scope of available resources in some situations (Anderson et al, 2003). While the 2005 BHGI guidelines included assessment of HER-2/neu oncogene status and IHC detection of metastases in axillary lymph nodes including sentinel lymph nodes, it was classified as appropriate for high level resource settings where trastuzumab is available for treatment of HER-2/neu-positive cancers.

Several promising international collaborations to improve diagnostic pathology services are in place. One between the Ghanaian Komfo Anokye Teaching Hospital (KATH) and the University Hospital of North Norway (UNN), resulted in development of a 5-year plan to re-establish surgical pathology at KATH, where hematoxylin and eosin (H&E) stained slides have been sent to UNN for review and Ghanaian pathologists received training at UNN (Stalsberg et al, 2008). Since that collaboration, KATH has improved cancer surgical pathology diagnosis from 35% in 2004 to >80% in 2010, and pathology services were extended to cover Regional and District Hospitals in northern Ghana (Awual, 2012).

A collaboration between the Malawi Ministry of Health, Kamuzu Central Hospital, and the University of North Carolina at Chapel Hill in the United States (U.S.), resulted in the opening of the first diagnostic pathology laboratory in Lilongwe in 2011. The authors cited virtual microscopy or ‘telepathology’ as an important aspect in building a collaborative relationship between pathologists and clinicians in Malawi and the U.S., allowing exchange of ideas, and professional development activities. Over the first two years of operation, the laboratory described an increasing workload, a transition away from reliance on telepathology, and the return of a number of Malawian pathologists to the laboratory from other countries (Gopal et al, 2013). Similar collaborations to develop capacity have been described in Uganda (Stulac et al, 2015). Finally a variety of volunteer organizations have coordinated the efforts of volunteer pathologists to improve and provide affordable pathology services to underserved patients in LMICs, by establishing pathology laboratories, providing diagnostic pathology services, and training local physicians as pathologists. As of 2011 projects have been completed or are currently active in Kenya, Eritrea, Madagascar, and Ghana (Hoenencke et al, 2011).

Cancer Registries

Over 70% of the burden of the increasing incidence of breast cancer will fall on LMICs who are ill-equipped to deal with this burden. The availability of high-quality population-based cancer registration system is a vital component for any evidence-based cancer control program, since it provides direct evidence of changes in outcome following policy changes and interventions. Adequate data on breast cancer incidence and mortality and associated demographics is essential for assessing the burden of cancer, prioritizing health spending, and evaluating the effectiveness of cancer prevention and control programs. In the recent CONCORD-2 analysis, the authors commented that the absence of civil registration and cancer registry systems in participating countries in Africa made the assessment of recent survival trends from available data almost impossible (Allamani et al, 2015).

In an attempt to address the dearth of cancer registries across the continent, The African Cancer Registry Network (AFCRN) was inaugurated on 1st March, 2012, has 22 members, and aims to improve the effectiveness of cancer surveillance in sub-Saharan Africa (African Cancer Registry Network (AFCRN), 2011). AFCRN partners with IARC within the framework of its Global Initiative for Cancer Registry Development (GICR) in LMICs to provide a network Regional Hub for cancer registration in Sub-Saharan Africa (World Health Organization, 2015c). AFCRN provides technical and scientific support to countries seeking to establish population-based cancer registries, advocating for cancer registration in this region, and coordinating research projects and disseminating findings and guidelines. Based on past knowledge and existing opportunities, an initial set of 15 starter countries has been selected for each region. The ACRN and GICR aim to have initiated work on registry-related activities in 20 low- and middle-income countries by 2020 and a further 30 by 2025 (World Health Organization, 2015c).

While the Cancer Incidence in 5 continents (C15, Volume IX) utilized data from only 6 registries which had data of sufficient quality for its estimates; Volume X utilized 8: Algeria (Sétif), Egypt (Gharbia), Libya (Benghazi), Tunisia, Malawi (Blantyre), South Africa (PROMEC), Uganda, (Kyadondo County), and Zimbabwe, (Harare) (Forman et al, 2013). A recent paper describing the results of a survey of 23 of the 25 active registries in Africa 2014 (Gakunga et al, 2015) pointed out that while few African registries have meet the high standards of completeness and validity required for inclusion in these analyses, many are functioning well to agreed ACFRN standards, and can be used for national cancer control planning. This survey found that 23 registries who responded had catchment populations ranging from 87,000 (Seychelles) to 48,235,000 (South Africa), with a corresponding range in numbers of cases registered (164–52,706 per year). The majority of data collection was active, and the timeliness of the registries was comparable to that of registries in Europe (Gakunga et al, 2015). Despite these promising changes, however, 19 countries in Sub-Saharan Africa (23% of the population) have no available information on cancer incidence or mortality (Ferlay et al, 2015).

Two relevant recent publications include a case study which described the barriers and facilitators to the implementation of a system for representative nation-wide cancer registration in Nigeria (Jedy-Agba et al, 2015), and a report on the current status of cancer surveillance activities including a pilot project in South Africa and use of the GICR framework to propose the development of four population-based cancer registries (Singh et al, 2015). The Kumasi Cancer Registry in Ghana, in collaboration with AFRCN, successfully transitioned from a hospital-based cancer registry (initiated in 2004) into a population-based cancer registry in 2012 providing data on cancers in the Ashanti Region (Laye et al, 2014). Within the past 10 years a number of other countries have either re-established or scaled up cancer registries. For example in 2011, South Africa’s Department of Health instituted compulsory cancer registration. While the National Cancer Registry was established in 1968, it had become almost inactive after 2004 because of a lack of resources (National Cancer Registry of South Africa, 2015; Singh et al, 2015a, Stefan et al, 2013). In Egypt, a National Cancer Registry Program of Egypt was established in 2007, and now has a network of population-based registries that contribute data to the national cancer registry (Ibrahim et al, 2014, National Cancer Registry Program of Egypt; Stefan et al, 2013).

Access to Treatment

While accessed differently, many women do not seek appropriate care when breast cancer symptoms arise, resulting in late stage diagnoses. When women do seek care, treatment is often unavailable due to lack of access to trained personnel, lack of available treatments and economic barriers. For example, a study in Yaoundé General Hospital (YGH), the only hospital in Cameroon where cancer patients can receive chemotherapy from trained medical oncologists, interviewed 79 consecutive patients with a diagnosis of breast cancer, Kaposi’s Sarcoma, or lymphoma in 2010. The delay between first consultation with a health care provider and receipt of a cancer diagnosis was >3 months for 47% of patients. The total delay from the first sign of cancer to receipt of the correct diagnosis was >6 months for 63% of patients. 40% of patients interviewed spent >$200 on a single round of chemotherapy (Price et al, 2012). The latter highlights a significant barrier to receiving treatment in many African countries: the prohibitive cost (Kendig et al, 2013). A Ghanaian retrospective study reported that 79.4% of patients with advanced breast cancer cited economic barriers to treatment (Scherber et al, 2014).

Appropriate treatment for breast cancer includes surgery, radiotherapy and systemic therapy. Systemic therapy for breast cancer can include chemotherapy, hormonal therapy and targeted agents and can be administered pre-operatively (neoadjuvant therapy), as a treatment of locally advanced breast cancer, or post-operatively (adjuvant therapy) for metastatic disease. A retrospective study from 2007-2010 identified the majority of cancer treatments in Malawi as palliative in nature (Kendig et al, 2013).
Radiotherapy

Radiotherapy is an important component of breast cancer treatment programs. Nigerian women with breast cancer diagnosed between 2005 and 2008 and who received a combination of receiving surgery/chemotherapy/radiotherapy had a significant increase in survival outcome compared to those receiving surgery/chemotherapy alone (Wakarajia et al, 2014). However like many other breast cancer services associated with improved outcome, many African countries are at a significant disadvantage with respect to availability of radiotherapy resources. The IAEA Program for Action for Cancer Therapy (PACT) estimates that there is a lack of at least 5,000 radiotherapy machines in developing countries, and that up to 70% of patients in these countries who may benefit from radiation medicine do not receive it (IAEA, 2015c). The African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA) agreement, in cooperation with the International Atomic Energy Agency (IAEA) which funds approximately 75% of AFRA’s budget, provides a framework for its 39 African Member States to collaborate on programs and projects focused on their specific shared needs. AFRA described significant barriers to improving access to nuclear science and technology including lack of adequately skilled and trained personnel and lack of basic nuclear infrastructure in some member states. However, AFRA did identify a number of positive points such as local and international collaborations; implementing AFRA best practices in the region; and African stakeholders focusing on enlarging the scope and sustainability of a number of nuclear programs (AFRA, 2013).

A recent review of the status of radiotherapy in Africa examined the Directory of Radiotherapy Centers (DIRAC), a database by the IAEA, which is estimated to include 90% of existing radiotherapy facilities worldwide, and contains information about external beam radiotherapy, brachytherapy, dosimetry, auxiliary equipment, and trained personnel. The review was a longitudinal assessment of the state of radiation oncology resources in from 2002-2012, and found a direct correlation between gross national income per capita, and average number of teletherapy machines per million population: 8.6/106 population for high-income countries; 1.6 for upper-middle-income countries, 0.71 for lower-middle-income countries; and 0.21 for low-income countries. The 160 radiotherapy centres in Africa have 277 radiotherapy machines (98 cobalt60 units and 189 linear accelerators). However the majority of the machines were located in South Africa (33%) and Egypt (27%), and approx. 20% of the African population live in one of the 29 countries that do not have any teletherapy facilities (Table 1) (Abdel-Wahab et al, 2013; Grover et al, 2015).

A 2011 paper arising from the International Conference on Advances in Radiation Oncology (Salmien et al, 2011) discussed new and existing technologies that may be suitable for LMICs, and identified barriers to establishing basic radiation therapy services in LMICs, including a global medical education list now includes five chemotherapy medications commonly used to treat breast cancer (World Health Organization, 2015d). However, a commentary on the essential medicines list pointed out that labelling a medicine as essential does not guarantee patient access, especially in LMICs, and should be regarded as a first step in the policy process towards assuring access to these medicines, as part of broader global health and sustainable development goals (Gray et al, 2015). The BMJ guidelines stratified by disease stage and resources level recommend classic cyclophosphamide, methotrexate, and 5-fluorouracil (CMF), doxorubicin and cyclophosphamide (AC), epirubicin and cyclophosphamide (IC) and 5-fluorouracil, doxorubicin, and cyclophosphamides (FAC) for adjuvant chemotherapy for stage II breast cancers; and pre-operative chemotherapy with AC, IC, FAC or CMF for stage II B. In limited resource settings, additional stage I-III adjuvant therapy with classic CMF, AC, IC or FAC, and classic CMF and anthracycline monotherapy or combination treatment for stage I-II metastatic and recurrent breast cancer treatment, are added to the model. Finally, in enhanced settings taxanes for stages I-II, and sequential single agent or combination treatments with Trastuzumab and Lapatinib for stage IV breast cancer are recommended (Eniu et al. 2008).

In Ghana a retrospective study of medical records for 597 breast cancer patients seen in 2008-2011 examined patient management and treatment patterns. Late stage at diagnosis was common, treatment plans of the study hospital were relatively standardized according to disease severity, and defaulting/interrupting treatment in the records was also common. Patients diagnosed with late stage breast cancer who received adjuvant therapy and patients with known hormone status evaluation were more likely to have complied with treatment guidelines and continued oncotherapy compared to those who never had hormone status requested or reported (Scherber et al, 2014). A small Sudanese study of 98 breast cancer patients with locally advanced disease (Stage IIIa-c) observed with locally advanced breast cancer and treated with neoadjuvant chemotherapy using therapies appropriate for basic level resources, observed a good clinical response rate with 11.2% with a complete clinical remission and 72.4% has a partial remission (Mawad, 2014).

However financial barriers to completing chemotherapy regimens where they are available have been reported. A small Nigerian study found that number of patients on neoadjuvant chemotherapy declined to 46% by the last cycle during a six-course treatment regimen, principally due to financial reasons as treatment was an out-of-pocket expense (Anyanwu et al, 2010). In Eritrea, a resource-poor country, a small study of 82 breast cancer patients where over 66% were diagnosed with late-stage disease between 2007 and 2008, only 1 patient received chemotherapy; the remainder were managed by surgery only. In comparison a cross-sectional study from the Egyptian Gharbain population-based breast cancer...
In the absence of breast early detection or screening programs, culturally appropriate education and awareness campaigns have been widely supported as a method to improve awareness of breast cancer symptoms among women in LMICs, and to encourage them to seek early diagnosis and treatment (Anderson et al., 2008). While education and awareness campaigns are of vital importance in LMICs, there are a variety of unanticipated barriers to implementing them. These include lack of awareness, knowledge and poor health literacy. For example, there have been some efforts to provide education to women on the importance of breast health in Sierra Leone (Shepherd et al., 2006), a study of 3,645 women identified minimal education, poverty and reliance on traditional healers as barriers for women with breast masses (Ntirenganya et al., 2014). A Nigerian study identified a number of economic and cultural barriers to implementing education about basic screening programs including lack of both specialized health personnel and breast cancer screening facilities, the absence of biomedical terminology in local languages, gender inequality and the prevailing influence of traditional health practitioners (Asobayire et al., 2014).

A lack of knowledge of the importance of breast health awareness and of the importance of breast cancer early detection leads to a lack of screening practices, even at the basic level. In an Egyptian study in 2006, only 10.4% of 365 newly diagnosed breast cancer patients, had practiced BSE, and 2.7% reported monthly BSE (Abdel Fattah et al., 2000). In Morocco, a study of 136 female doctors found that while 75% of study participants practiced BSE once a month, only 15% ever had a mammogram (Shanmugam et al., 2011). A cross-sectional study in Tunisia of 900 women reported poor knowledge of specific risk factors for breast cancer and of breast screening modalities, with only 14% of women performing any type of breast screening (El Madama et al., 2013).

Non-governmental organizations (NGOs) are important resources for many countries in this region, as they partner with governments with a goal of reducing cancer mortality in this region, often by promoting early detection, diagnosis and treatment and reducing the stigma that often surrounds a cancer diagnosis (Duklewke et al., 2013). A number of pilot projects by governmental and non-governmental organizations have attempted to increase breast cancer awareness in urban and rural areas across Africa, with a variety of success. For example, in North Africa the Algerian government, in partnership with Roche and a patient advocacy group El Amal (Heape) launched a mobile mammography unit in 2013, which brings trained nurses, and other healthcare workers to remote regions within Algeria, with a goal of combining breast cancer education with screening facilities. Other countries such as Tunisia are focusing on prevention and early detection of cancer as part of their national strategy in the fight against cancer (2010-2014).

In the absence of formal guidelines in many West African countries, a number of awareness and educational campaigns have been initiated. In Ghana, a cross-sectional survey assessed the impact of an education program on knowledge, attitudes and practices toward breast cancer and breast cancer prevention among women from rural communities, and found that knowledge about breast cancer symptoms improved, and the number of women who reported beginning BSE increased (Menya et al., 2014). There have been multiple studies of awareness, attitude and practice of breast examination in Nigerian women. Knowledge and practice of BSE and CBE vary widely, but women who have received a tertiary education are consistently more likely to be aware of and the conduct BSE. The Free Breast Cancer Awareness and Screening program launched in Nigeria in 2006 in collaboration with the Ministry of Women Affairs and Poverty Alleviation educates women about BSE (Lagos State Ministry of Health, 2011) and performs free counselling and referral services. While there are no governmental guidelines on breast screening in Cameroon, there are periodic mass campaigns for breast health awareness and CBE organized by the Ministry of Health (Kemfing Ngoya et al., 2011a). A number of cross-sectional surveys in African women found that knowledge of preventive measures and risk factors was poor in women in Cameroon (Suh et al., 2012). An NGO, SOCHIMIO (Société Chimiothérapie) is a Cameroonian NGO affiliated with the UICC, based in Yaoundé that has initiated several cancer research projects in Cameroon. While these are primarily aimed at providing therapeutic care to cancer patients, they have also implemented educational outreach programs (Société Chimiothérapie (SOCHIMIO), 2014).

In South Africa, the government and a variety of NGOs provide community outreach and educational materials to increase awareness of breast cancer signs and symptoms. These include mobile breast check units which travel to semi urban and urban areas offering free CBE, education in BSE and other awareness campaigns (Cancer Association of South Africa, 2014). In Swaziland, the SBCN’s educational programs aim to increase awareness on aspects of breast cancer including the promotion of BSE annual medical examinations and the importance of early diagnosis and treatment (Swaziland Breast Cancer Network, 2008).

In an Ethiopian study designed to improve health workers’ knowledge and awareness using an abbreviated training intervention reported that initial knowledge and practice skills related to CBE were low, but improved significantly post-intervention (Nutubet et al., 2013). A number of NGOs in Kenya such as Cancer Free Women support a variety of awareness and education campaigns including g-teaching BSE and symptoms of breast cancer to Kenyan women (Cancer Free Women, 2013). In Madagascar a variety of NGOs provide preventive care initiatives, and education and awareness campaigns (4aWoman, 2014). In Rwanda, an NGO Breast Cancer Initiative East Africa (BCIEA) launched a month-long campaign in Kigali, Rwanda, to provide free BSE for women and to persuade both women and their partners the importance of cancer awareness (Kigali, 2014). Finally, NGOs in Zimbabwe perform a variety of awareness programs to inform women about cancer prevention strategies and cancer screening procedures (The Cancer Association of Zimbabwe, 2014).

Breast Cancer Early Detection

Successfully down staging breast cancer in populations is dependent on successful early detection programs. Unfortunately, many African countries have limited resources to allocate to early breast-cancer detection resulting in late diagnosis, which is more difficult to treat effectively, and is associated with increased morbidity and mortality (Coleman et al., 2008). Even if breast cancer awareness increases among African women, access to mammography is limited to wealthier women living in large urban areas. Hence, current early detection efforts focus on promoting BSE, teaching women to recognize the early symptoms of breast cancer, and encouraging them to present for early medical evaluation when necessary. Most women presenting with breast symptoms receive a CBE, those with positive findings are referred to larger hospitals for diagnostic interventions such as fine needle aspirations and biopsies. The effectiveness of CBE depends on the examiner’s training and experience and is potentially limited by a high false positive rate, in some cases up to 85% (McDonald et al., 2004; Trapp et al., 1999). Nevertheless, CBE is currently used as the primary method for breast cancer detection in most regions of Africa because of its availability and low cost. Therefore, efforts to downstage breast cancer should include improving provider CBE training with the aim of reducing the number of false positive CBES which require referral and expensive diagnostic interventions.

Ultrasound is available in many facilities, even those located outside large urban areas, and it is less expensive than mammography. The capacity already exists among midlevel providers (sonographers and midwives) at these facilities to use this equipment to stage patients (medical problems, such as identifying potential complications related to pregnancy (McClure et al., 2014). With appropriate additional training, ultrasound use could expand to include evaluating women with positive CBES to reduce the number of women requiring referral and diagnostic interventions. Efforts to improve breast ultrasound training and use in Africa are currently in progress (Scheel et al., 2015).
North Africa

A number of countries in North Africa have developed recommendations for breast cancer screening, and several are making strides in scaling up successful pilot projects. WHO EMRO published guidelines on breast cancer screening in 2006, and in line with the BMHG, suggested that screening could be implemented in centralized cancer facilities where breast cancer treatments are available (Khatib, 2006). While these programs will only provide screening to a limited proportion of the population, they could act as pilot programs with the ultimate aim of expanding them to cover the entire population as more resources become available. Recommendations for screening frequency vary considerably in this region. A report by the Algerian National Institute of Public Health in 2003 identified a variety of issues in the prevention and diagnosis of late stage breast tumors and recommended a delay between presentation and diagnosis, and lack of access to screening and treatment protocols (Mammouda et al, 2003). While cancer has become a national priority with the publication of the 2014–20 National Cancer Plan (Hamdi Cherif et al, 2014), it is unclear whether any progress has been made. No data on breast screening policies or practices were found. Some opportunistic pilot projects in Algeria are in place such as a partnership between the Algerian government, IFSI, and a patient advocacy group El Amel (Hope), which launched a mobile mammography unit in 2013.

Similar to other countries in the area, women in Egypt present frequently with advanced breast cancer (Omar et al, 2003; Safaia et al, 2011). The Women’s Health Outreach Program recommends monthly BSE starting at age 20, and offers annual breast cancer screening for all Egyptian women above the age of 45 years (Salem et al, 2008; Women’s Health Outreach Program, 2014). The program was made up of 3 phases with a 1-year pilot phase (2007-2009) to identify barriers in implementation. Each implementation phase will address a number of governorates. The target of the 5-year implementation plan is to provide coverage for the entire population. Screening is delivered in an opportunistic fashion through mobile units equipped with digital mammography units which serve rural and less affluent regions. Asymptomatic women are invited to return in a year’s time for a repeat mammogram (Women’s Health Outreach Program, 2014). However the program was criticized as being both expensive and ineffective and not the most effective use of resources: fewer than 90 true cases of cancer were found as a result of 20,000 mammograms (Harford, 2011, Stefan et al, 2013). More effective alternative methods of breast screening have also been explored, including training women resident in a Cairo slum in breast health awareness and BSE (Kharboush et al, 2011). Another study which randomized 14,887 women to CBE vs. a control arm demonstrated high acceptance, with 85–91% of the women targeted enrolling in the study. Initial results demonstrated that stage distribution was significantly better in the intervention arm compared to the control arm (Miller, 2008). The Egyptian National Screening Program, the Women’s Health Outreach Program (WHOP), was launched 2007; prior to this, a study conducted by United States Agency for International Development reported that only 1.7% women aged 40 and above had had a mammogram within the past 12 months (Corbex, 2009; El-Zanaty et al, 2003). While cancer has become a national priority with the publication of the 2014–20 National Cancer Plan (Hamdi Cherif et al, 2014), it is unclear whether any progress has been made. No data on breast screening policies or practices were found. Some opportunistic pilot projects in Algeria are in place such as a partnership between the Algerian government, IFSI, and a patient advocacy group El Amel (Hope), which launched a mobile mammography unit in 2013.

Morocco set up a National Cancer Prevention and Control Plan (NCPCP), comprising a coordinated breast cancer awareness campaign and a program aimed at developing breast cancer screening was in 2010, aimed at targeting half-a-million women. A new breast and uterine cancer screening and early detection center was opened in 2013 in Mhammeda, which provides screening facilities for more than 40,000 eligible women. Mobile mammography units travel to remote areas to provide opportunistic screening to those without access to centralized screening facilities. The NCPCP in Morocco has developed a 3-tiered system for increasing screening coverage: Level 1 health care clinics with general practitioners and nurses who provide breast health education and CBE to women, Level 2, specific reproductive health clinics who receive referrals from Level 1 clinics and perform diagnostic ultrasound and mammography; and Level 3, oncology centres. Breast cancer screening is recommended for women between the ages of 45–69 (The Foundation Lalla Salma, 2016). The Tunisian Ministry of Health has stated goals of focusing on prevention and early detection of cancer as part of their national strategy in the fight against cancer (2009–2014), and currently recommends annual CBE for women aged 40-69 years, with mammography reserved for high-risk women and those referred after primary screening via CBE. The State has implemented a number of pilot programs examining the efficacy and feasibility of mammographic screening in the general population. Based on the results of these programs the Tunisian government will consider moving toward population-based mammographic screening (Association Tunisienne pour la Recherche et les Etudes en Pharmacie, 2016). One of the first pilot studies in 2003 was a large scale population-based mammographic screening in urban areas, but participation rates have tended to be low (Bouchkila et al, 2009; Zaazour et al, 2009). The most recent evaluated three rounds of mammography screening as part of a pilot program, carried out between 2004–2010 in Sfax, Tunisia. Biennial screening was offered to women aged >45 years, and 17.4% of the target population underwent screening, resulting in 12,657 mammograms (Filhka et al, 2013).

Sub-Saharan Africa

A number of countries lack either guidelines and/or data on screening guidelines or practices including: Libya, and Mauritania, in North Africa; Angola, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Equatorial Guinea, and Gabon in Central Africa; Republic of Benin, Burkina Faso, Gambia, Guinea, Ghana, Guinea-Bissau, Liberia, Mali, Mauritania, Namibia, Nigeria or Senegal, or Togo in western Africa; Ethiopia, Rwanda, Kenya, Malawi, and Zimbabwe and in Eastern Africa. Where mammography does exist in these countries it is often limited to private hospitals; (Msyamboza et al, 2012) and are centralized in major urban centres (Ly et al, 2012). For example, the Lagos State Ministry of Health reported there are only 4 functional mammography units in Lagos, utilization of mammography is rare and most women are unaware of its use as a screening tool (Lagos, 2014). However, many countries in the region are developing innovative low-cost early detection methods: that can be used effectively in low resource settings. While Sudan lacks guidelines on age at which cancer screening should begin (Abudris et al, 2013b) it established a National Cancer Control Program in 1982, which focuses on prevention, early detection and screening. Unfortunately, a lack of resources has hampered implementation of breast cancer screening and the majority of efforts have been focused on public awareness campaigns and education of medical professionals (Hamal, 2006). However, a Sudanese study trained female volunteers to detect breast abnormalities while visiting households in 56 villages in an intervention county, while the control county received no intervention. The volunteers screened 80-180 women >18 years for breast abnormalities, and referred those with suspected breast cancer for medical diagnosis and, if necessary, treatment at a district hospital. From 2010-2012, 10 309 (70%) of 14 788 women in the intervention county were screened. 138 women were identified as having breast abnormalities and were referred for diagnosis and treatment. In the 118 women attended the hospital, 101 were diagnosed with benign lesions, 6 with carcinoma in situ, and 9 with malignant disease. In the control villages, only four women attended the hospital for diagnosis: one was diagnosed with a benign lesion and three with advanced disease (Abudris et al, 2013a).

In recognition of the need to develop formal guidelines, a report by the Kenyan Ministry of Health called for enhanced health promotion and education, and improved early detection by introducing or expanding screening programs, and by developing guidelines for screening and early cancer detection (Ministry of Public Health and Sanitation and the Ministry of Medical Services, 2012). However, many of these have yet to be implemented (Matheka, 2014). Health workers have been proposed as a link between the general population and access to care, especially in rural areas (Mutile et al, 2013).

There are no formal screening guidelines in Zimbabwe, but a number of non-profit organizations such as the Cancer Association of Zimbabwe and Breast Cancer Alleviation of Zimbabwe recommend breast health awareness and regular BSE for women aged 18 and older (The Cancer Association of Zimbabwe, 2014). A recent report by the Zimbabwean Ministry of Health on a strategy setting out national goals for cancer prevention and control from 2014-2018 identified a series of barriers to breast and other cancer screening. These included lack of access to early detection; inadequate resources, environment and technology; lack of education and awareness of the importance of regular cancer screening, prohibitive costs of screening services, and lack of referral of patients. The goals of this strategy included a reduction of late stage breast cancer presentation from 80% to 50% by 2018 (Ministry of Health and Child Care of Zimbabwe, 2013).
Breast cancer incidence rates have increased over the last 20 years in Uganda (Wabinga et al, 2014). The average age in Uganda is low: Uganda Bureau of Statistics (UBOS), 2002, with a peak age at diagnosis of between 40 and 50 years. The limited health care budget and resources in Uganda are directed towards fighting communicable diseases (Galukande et al, 2010). In 2012, there were 4 mammography units in Uganda, (2 in government and 2 in private health units) and 42 radiologists (Monu et al, 2012). Galukande and Kiguli-Malwadde commented on the greater availability and lower cost of ultrasound as a potential breast cancer screening tool in Uganda. Although there is some government subsidised healthcare, the majority of the population has to self fund care. Consequently, in the Breast Cancer Guidelines for Uganda (written by a team of oncologists, surgeons and radiologists from Kampala) BSE is recommended for its practicability and affordability (Galukwe et al, 2008b).

No data were found on breast screening policies or practices for countries in Southern Africa, with the exception of the Republic of South Africa. The public-sector health service emphasizes community level healthcare complemented by a hierarchical referral system through district hospitals: breast cancer symptoms are usually detected by cancer patients rather than via screening, who then attend primary health care clinics. They are then referred to secondary and tertiary level clinics and hospitals for diagnosis and treatment. The NGO Cancer Association of South Africa (Cansa) recommends monthly BSE for all women and regular CBE. Yearly mammograms are recommended for women over the age of 40, however these are not free (Cancer Association of South Africa, 2014). Cansa provides education about the importance of early detection and performs opportunistic screening via CBE through mobile health clinics and Cansa care clinics throughout South Africa (Cancer Association of South Africa, 2014). Mammograms are offered through public hospital breast clinics.

In 2010, the Swaziland Breast Cancer Network (Sbcn) operated three breast cancer clinics, which offer free consultations, examinations, diagnosis and referrals. SBCN recommends monthly BSE, and annual CBE by a trained provider, and has developed a referral tool for further diagnostic work for patients who report suspicious findings. It is unclear whether the SCDN is affiliated with the Swazi Ministry of Health: no formal guidelines on breast screening were found on the Ministry of Health's website. While the SBCN recommends that all women over 40 should undergo mammography, it recognizes that mammography is used only very occasionally by those who can afford this service (Swaziland Breast Cancer Network, 2008).

Finally, unlike many countries in the region, Mauritius is a HIC with a 5-year survival rate from breast cancer that is similar to other HICs (Allemam et al, 2015). The republic developed a National Cancer Control Program for 2010-2014, and recommended that breast health awareness campaigns encouraging BSE and yearly CBE to women >40 years. Population based screening mammography was not thought to be advisable, given the relatively high proportion of cancers in women younger than 45 years (Republic of Mauritius, 2014). Diagnostic procedures such as MRI and CAT scans are available as is radiotherapy and chemotherapy (Mauritius, 2015). The Republic of Mauritius is one of the few countries in the region with formal guidelines on breast cancer screening.

Screening Practices and Behaviours in Africa

In Ghana, the majority of women are diagnosed between the ages of 40-49 (Wiedu et al, 2006). In a small cross-sectional study, the rates of breast screening practices was poor, with the self-reported BSE rate of 32%, CBE 12% and mammography 2%, with higher levels of education strongly associated with screening behaviours (Opoku et al, 2012). A Senegalese cross-sectional study in 2006 interviewed 300 patients attending 5 hospitals in Dakar for a medical or surgical consultation for breast health related issues, on knowledge and practice of BSE. Study participants were young, with an average age of 34 years, uneducated and living in poverty. Participants were aware of BSE (42.7%) and 29% regularly practiced BSE. Practice of BSE was associated with income and educational attainment (Guye et al, 2009).

In Cameroon, a 2011 retrospective study examined the medical records of 531 breast cancer patients diagnosed at Yaoundé Medical Hospital between 1989 and 2009: self-detection was the mode of detection in 93.1% of patients, and only 2.9% of patients were diagnosed via mammography or CBE. Seventy-one% of patients presented at late stage (Kemfang Ngowa et al, 2011a). A study interviewing women appearing at Yaoundé General Hospital with Stage IV cancer, found that the main reasons for delay in seeking medical care was inability to pay, inadequate diagnosis by general doctors; beliefs, fears, cultural factors including a fatalistic attitude after a diagnosis of cancer, and lack of knowledge about breast cancer (Ekottar et al, 2007). A cross-sectional survey in Cameroon of 120 women in 2012 reported that while 74.2% of women had heard of BSE, 40% had never performed it. In Nigeria, a study of 221 undergraduate students reported that 85.1% were aware of BSE, 73.1% were knowledgeable about BSE, but only 11.8% were aware of the ideal age to start BSE (Iwaro et al, 2009). A second Nigerian study of 393 students reported that 67.9% of those who had heard of breast cancer knew that there were screening methods available, of these 83% of those who had heard of BSE, 93.2% were aware of CBE and 62.8% were aware of mammography as a screening method. However only 50% of respondents who were aware of breast cancer practiced BSE, and only 76% of respondents had ever undergone any form of clinic-based screening (Olugbenga Bello et al, 2011).

A national population-based cross-sectional study of 2202 women in the Republic of South Africa, found that only 15.5% ever reported having a mammogram; screening was associated with White or Indian/African population group, greater wealth, and having health insurance (Peters et al, 2014). In a study of 40 women aged 40 years the detection rate was 3.8/1000 exams, and in women 50-69 years 9.7/1000 (Apfelstaedt et al, 2008).

A 2012 study of 390 health workers in northwest Ethiopia found that 37% of respondents had ever practiced BSE and 14.4% practiced it regularly. The main reasons for not performing regular BSE were not having problems with breasts (53.2%), not knowing the technique (36.6%), and not knowing its importance (21.4%); knowing the importance of BSE was a predictor of BSE practice (Azage et al, 2013).

Qualitative studies of women in this region report a variety of barriers to seeking early diagnosis, or participating in screening. Data from 69 Ethiopian breast cancer patients found that even among women who are aware of breast cancer, early signs/symptoms are frequently ignored, traditional healers are preferred, and study participants indicated that stigmatization and social isolation complicate discussion and action around breast cancer (De Ver Dye et al, 2011). A qualitative study of Kenyan women reported differences between rural and urban women with respect to knowledge of symptoms and the importance of breast screening. The majority of women were fatalistic about the disease and assumed it to be incurable (Muthoni et al, 2010).

Despite the lack of governmental guidelines on breast cancer early diagnosis, and low levels of awareness about the importance of breast self-awareness, a number of countries are implementing pilot studies in an attempt to reach underserved populations. A recent paper from the Democratic Republic of Congo reported use of BHGI guidelines in implementing a breast cancer awareness campaign in Kinshasa from 2010-2012, based on BSE and CBE by trained healthcare workers (Luyeye Mvila et al, 2014). Participating women underwent CBE and in the case of suspicious findings, received a mammogram and ultrasound, and where necessary FNA. A total of 4,113 women were screened, of whom 1,113 underwent mammography screening. A pilot screening program using a mobile mammography unit in the Western Cape province in the republic of South Africa in women aged 40 years and older between 2011-2013, performed 2,172 screening mammograms, with a 12.2% recall rate (Apfelstaedt et al, 2014). The authors reported multiple problems, both technical (such as poor quality images) and administrative (e.g., images not reaching the referral centre) and a low cancer detection rate, concluding commencement of a screening program using this model was not justified in this setting.
Conclusions

While the situation in many African countries paints a bleak picture for breast cancer care, due to over-burdened or non-existent health care infrastructures, poverty and increasing rates of breast cancer, which are commonly diagnosed at late stages, the outlook on some fronts calls for optimism. Some African nations are working to create national and international networks to improve aspects of breast care. Governmental initiatives through cancer control planning, public/private partnerships, institutional training, and the use of available tools such as the BHGI resource-stratified guidelines can allow local stakeholders to develop novel and innovative measures for improving breast health care. The use of awareness education and distributed models of care to facilitate breast cancer down-staging is essential for most of Africa in order to decrease the number of patients who are unrealistic or inappropriate candidates for curative treatment and instead should be the focus of palliative efforts. Diagnostic services based on tissue sampling is essential, both for making cancer diagnoses, but also for determining proper treatment planning. The prolonged time from initial diagnosis to treatment is so lengthy as to be a measurable aspect of worsened breast cancer outcome. In addition, healthcare systems in Africa need to be expanded and supported such that patients who begin a treatment regimen are likely to complete it. Through this type of systematic approach to breast cancer care delivery in Africa, we can realistically anticipate seeing improvements in breast cancer outcomes given resources for organizational restructuring and time for realistic implementation.

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Abdel-Fattah M, Zaki A, Bassili A, el-Shazly M, Tognoni G. Breast cancer outcome. In addition, healthcare systems in Africa need to be expanded and supported such that patients who begin a treatment regimen are likely to complete it. Through this type of systematic approach to breast cancer care delivery in Africa, we can realistically anticipate seeing improvements in breast cancer outcomes given resources for organizational restructuring and time for realistic implementation.

Chapter 12 - Africa Breast Cancer

The State of Oncology in Africa – 2015

Muthoni A, Miller AN. An exploration of rural and urban in breast cancer awareness: innovative strategies for resource


The African continent ranks second in the world in terms of area, covering about one-fifth of the whole land surface of the Earth. The continent is divided among 54 countries (Western Sahara, although a member of the African Union, has its statehood disputed by Morocco (CIA, 2015)). Africa ranks second also with regard to its population size, amounting, in 2015, to an estimated 1.17 billion inhabitants (United States Population Reference Bureau, 2015). Out of these, 486 million (43%) are children, aged between 0 and 14 years.

Over the last decade, the economy of the continent has grown at an annual rate of over 5% (Middle East and Africa, 2015) and this growth has reflected, among others, in an improvement of the health of its inhabitants. The progress is not, however, in proportion with the economic growth, and is definitely short of the targets of the UN Millennium Development Goals (MDG). For example, the children under-five mortality rate has indeed decreased in Northern Africa from 73/1000 births in 1990 to 24/1000 in 2015, which means that the region has attained the target set according to the MDG. But the situation in Sub-Saharan Africa is far worse: from 180/1000 in 1990, the child mortality has decreased only to 83/1000 in 2015, whereas the proposed target was 60 (Unicef et al, 2015).

Similarly, with regard to the control of childhood cancers, Africa registered relatively little progress. According to the estimations of the International Agency for Research in Cancer (IARC), the incidence of paediatric (0 to 14 years of age) malignancies on the continent is 8.0/100,000. This incidence rate, together with the mortality rate of childhood cancer (of 4.6/100,000) is comparable with the average estimates for the world as a whole (see Table 1) (Feilay et al, 2013). A comparison of the same parameters with those recorded in the very high human development (VHHD) nations, as defined by The United Nations (United Nations Development Programme, 2015) indicates that, even if the incidence of childhood cancer in Africa is almost half that of the VHHD areas, the mortality is twice as high (Table 2).
Patterns of incidence of various malignancies in African children (see Table 1) depict a pattern which appears to differ from that of the world as a whole: non-Hodgkin lymphoma is the dominant cancer, whilst in the world leukaemia is the most frequent one. Additionally, kidney tumours are in the third place in Africa, whilst in the world they do not appear among the three most frequent cancers. However, in the VHHD areas, renal malignancy also appears in the third place.

The excess of NHL in Africa is the consequence of the high (Orem et al, 2007) incidence of Burkitt lymphoma over a vast area in Sub-Saharan Africa, spanning from The Gambia in the west to Kenya in the east and descending over Malawi, northern Zimbabwe and Mozambique in the south: "the lymphoma belt". This very same area is where malaria is endemic, and a co-operation between malaria and Epstein – Barr virus infection probably plays a role in the pathogenesis of Burkitt lymphoma (Sugden, 2014).

The HIV epidemic plays a similar role, of enhancing the oncogenetic properties of the Epstein – Barr virus, as the incidence of Burkitt lymphoma (and that of other NHL) is augmented in areas of widespread HIV infection. With regard to the kidney tumours, consisting in around 90% of cases of nephroblastoma, their slight predominance on the African continent is not yet completely explained.

Without detracting from the value of the IARC estimates of the incidence of various cancers in the world, it is important to realise that in many geographical areas there are no reliable registers of cancers, let alone of paediatric cancers. In such situations, the epidemiologist is reduced to extrapolating data obtained in a limited area to the whole country or even to use figures obtained in the neighbouring countries, in order to evaluate the incidence of malignancies.
A recent study (Stefan, 2015a) collated data on childhood cancer obtained from 21 registries situated in 18 countries across Sub-Saharan Africa, mainly from the year 2000 to 2010, but in some cases from as far back as 1985 to as recent as 2012. Among the participating registries, the incidence of childhood cancers is known to differ substantially, from 5.5/100,000 in Congo (Brazzaville) to 12/100,000 in Zimbabwe and 4.5/100,000 in South Africa (Chokunonga et al, 2013; Nsonde Malanda et al, 2013; Stefan et al, 2015).

The study also reflected differences, among countries, with regard to the most frequent childhood cancer (see Table III). NHL, consisting mainly of Burkitt lymphoma, was confirmed to be on top of the list of childhood cancers in those countries forming the "lymphoma belt": Kaposis Sarcoma, known to exist endemically in large areas of Sub-Saharan Africa and which, additionally, has soared to even higher incidence due to the HIV epidemic, appears in first place among children's cancers only in Uganda and Mozambique. Leukaemia has the highest incidence in South Africa, Zimbabwe and Namibia. A number of other malignancies were reported to be most frequent among childhood cancers in several countries; brain tumours in Lesotho, retinoblastoma in Congo (Brazzaville), nephroblastoma in Senegal and rhabdomyosarcoma in Central Nigeria (Jos regional registry). The above data differ in places from the IARC estimates. However, it would be futile to discuss the veracity of one or another finding, from any of the two sources. What this study illustrates is that we are still far from having a true representation of the incidence of various paediatric malignancies on the continent. It is imperiously necessary to institute national cancer registries there where they do not yet exist, if we are to have a realistic basis for devising effective policies to control cancer in children.

The malignancies with the highest incidence rates observed were, in decreasing order: leukaemia (1.19/100,000), renal tumours (0.6/100,000) and lymphomas (0.56/100,000). These figures are close to Gobocan estimations. A substantial difference in cancer ASRs was observed between white (11.6/100,000) and black children (3.7/100,000). A number of explanations were proposed for this: firstly, such differences were observed also in the United States, even if not of the same magnitude; it is therefore possible to find an explanation in ethnic or genetic particularities of the two groups. Secondly, it is possible that a number of cancers in black children are either misdiagnosed or are never entering the health system. Most of the white children live in urban setting, where they have better access to health institutions and where the quality of care is higher.

Moreover, the rates for black children observed by SACTR are considerably lower than those recorded elsewhere in Africa: for example, the Harare registry in Zimbabwe recorded a rate of 11.1/100,000 from 1990 to 1994. The explanation might be with the lower incidence of Kaposis Sarcoma and Burkitt lymphoma (BL) in South Africa, by comparison with countries situated to the north of it, where the prevalence of infections with the human herpes virus 8 (HHV-8) and Epstein-Barr virus (EBV) – the respective infectious agents associated with the two diseases – is much higher.

The above considerations introduce a different facet of this analysis. The incidence rates of cancers with a recognised infectious origin have increased considerably in Africa with the advent of the human immune deficiency virus (HIV) epidemic. As the epidemic was much more severe in Sub-Saharan Africa than in the Northern Africa, its effect on cancer was proportionally more powerful in the southern half of the continent. The most evident change associated with HIV infection in children was the drastic increase in the incidence rates of Kaposis Sarcoma. In Uganda, for instance, the incidence of Kaposis Sarcoma increased by a factor of 40 after the onset of the HIV epidemic (Ziegler et al, 1996). Another study in the same country found an odds ratio of 94.9 (95% CI 28.5-315.3) for acquiring Kaposis Sarcoma and of 7.5 (95% CI 2.8-20.1) for acquiring BL in children with HIV compared with controls (Newton et al, 2001). Comparable changes were seen in other Sub-Saharan countries.

This surge in the incidence of Kaposis Sarcoma and BL due to HIV infection was not observed in the rest of the world. The explanation resides with the pre-HIV endemic rates of infection with HHV-8 and EBV in numerous countries in the Sub-Equatorial area of Africa. These infections are sporadic in the rest of the world.

Findings from the South African Children’s Cancer Registry

The South African Children’s Tumor Registry (SACTR) was established more than 25 years ago, with the purpose of estimating the general burden of cancer among children in the country, while also giving an indication on the distribution of malignancies in term of relative incidence, ethnic group and region. All paediatric oncology units in the country contributed their data to the registry and reports were circulated at regular intervals, while all the registry content was available to contributors for research purposes. Ninety-four per cent of all diagnoses were confirmed by histology. Similar data quality is yet unmatched in Africa.

An extensive analysis of the records accumulated in the SACTR over the last 21 years (Stefan, 2015a) has highlighted a number of facts. Even if they might not apply to the whole of Africa, the review of the main findings may contribute to a better insight into the epidemiology of childhood cancer. To start with, the observed overall age-standardized (ASR) rate was 4.5/100,000, which is considerably lower than the Gobocan estimation of 8/100,000 for the whole Africa, but indeed only marginally lower than 4.9/100,000 which was the estimation for South Africa. The difference may originate in the fact that Gobocan data are obtained mainly from registries situated in urban centres, while the cancer rates in rural areas are lower.

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Chapter 13 - Africa Childhood Cancer

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Existing Resources for Childhood Cancer Control in Africa

At the present, there is no publication describing a continent-wide inventory of the available resources for the treatment of childhood cancer. In an attempt to shed some light on the matter, a questionnaire was administered to professionals working in 38 hospitals located in 29 African countries (Stefan, 2015b). The resulting analysis of the answers was published in 2015. The survey included 24 teaching hospitals and 14 regional hospitals. Out of the 38 centres surveyed, 17 had no paediatric oncologist. There, children with cancer were cared for by general oncologists or paediatricians, assisted in some places by general practitioners. Surgical treatment was available on site in 27 centres, with the remaining 10 referring their patients for surgery elsewhere.

The survey found a complete absence of specialised oncology nurses in the responding units. Moreover, the nurses were usually rotating between the existing wards, which made it even more difficult to train or employ a specialised (paediatric) oncology caregiver. In 14 centres, probably due to the small number of childhood cancer cases, there was no dedicated ward for this category of patients.

All centres surveyed were able to perform the usual laboratory tests, including bone marrow aspiration, but just one unit was offering bone trephine biopsy. Cytography was widely available and so was basic radiology too, however not all hospitals had computed tomography scanning (present only in 31 out of 38) or magnetic resonance imaging (23 out of 38). With regard to chemotherapy, in 8 centres the treatment had to be paid for; in part or in full, by the patient. This might not be affordable for all; covering the cost of cancer drugs was found, in a Tanzanian study, to require spending between one month and seven months of household income (Yohana et al, 2011). Radiotherapy was limited to 21 out of 38 centres. Palliative treatment was offered in 27 hospitals, but in 12 of them Morphine was not available free of charge.

The situation of the pathology diagnostic support was not evident from the study summarised above. Other authors (Adesina et al, 2013) found recently that in Sub-Saharan Africa, for the same population number, there were ten times fewer pathologists than in high-income countries. These specialists were not supported by enough technicians, had to work with inadequate equipment and were confronted with shortages of laboratory supplies (African Pathologists’ Summit Working, 2015) and infrastructure problems.

Last but not least, the survey quoted above looked at the contribution of parent support groups. For children with cancer, a parent support group is of major significance, as it may make the difference between accessing and remaining with the oncology programs or not. These non-profit organisations raise funds to facilitate transporting and lodging the children and their accompanying parent and often volunteer for various cancer related activities. Yet such parent groups were active in only about half of the centres surveyed.

Conclusions

Statistic data on childhood cancer on the African continent are imprecise, as the existing cancer registries have limited coverage and are of variable quality. IARC estimations indicate an ASR of incidence of 8 cases/100,000 and a mortality of 4.6/100,000. While comparable with the average figure of the whole world, the incidence rate is half as high and the mortality rate is usually double when compared with similar indicators from very high human development countries. In terms of incidence, NHL is most probably the dominant cancer in children in Africa, while leukaemia prevails in the rest of the world. This difference can be attributed to the endemic infection with EBV in an extensive area around the Equator, descending to the Tropic of Capricorn, corresponding also to the area of high prevalence of malaria. Epstein-Barr lymphoma is highly incident in this area, which is known as “the lymphoma belt”.

The HIV epidemic has exacerbated especially the incidence of another malignancy of viral aetiology, the Kaposis’ Sarcoma, whose rates in children have been found to increase between 30 to 90 times. Again, this increase, which was not seen in the rest of the world, was grafted on an endemic infection with HHV-8 in a number of African countries.

Facing this burden of disease, the manpower, skills, facilities and funds allocated to child cancer care need to increase considerably. This is even more justified by the fact that malignancies in children are highly curable, as proven in other regions of the world.

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The landscape of skin cancer in Africa has been dominated by the problem of Kaposi’s Sarcoma (see “Chapter 11” on page 213), occurring sporadically for many years, and more recently commonly found in HIV positive individuals. There has been less information available concerning other forms of skin cancer, which, although less common in Africa, are nevertheless causing significant concern. Ultraviolet radiation is the primary cause of skin cancer and skin pigmentation is partly protective. However, there are particular problems in those predisposed to develop skin cancer such as African patients with oculo-cutaneous albinism. The commonest skin problems seen in Africa to date, have been skin infections and inflammatory dermatoses, but there is an increasing prevalence of malignancies (Kiprono et al, 2014). Given the scarcity of information in Africa, parallels with skin cancer in Afro-Americans are informative of the nature of skin cancer in African skin.

**Global Picture of Skin Cancer**

There are two major groups of skin cancers: melanoma and non-melanoma skin cancers. Melanoma results from malignant change in melanocytes: the colour producing cells of the skin and eye. (Figure 1) Melanoma is the 9th most common cancer in Europe (Ferlay et al, 2013) and the 19th most common cancer worldwide with the highest incidence rates in Australia/New Zealand and the lowest in South Central Asia (Ferlay et al, 2012). In contrast with many cancers, rates are lower for both men and women living in the most deprived areas than the least deprived (National Cancer Intelligence Network, 2014). There is no doubt that skin cancer is increasing worldwide. In Europe age-standardized incidence rates increased more than 6 fold between the end of the 1970s and 2011-13, greater in men than women, which probably results from change in exposure to risk factors. Rates for Asian and African men and women are however significantly lower than white men and women.
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Heavy tan.

–

Suntan
Sometimes tans
Heavy tan
Never tans
Always burns
Sometimes burns
Always burns
Sometimes tans

258

analysed 98 cases (61% male) and found malignant melanoma, particularly lower limb in men, was commonest followed by cSCC, DFSP and BCC, 
quals living in geographically defined areas. For example a retrospective pathological study of skin cancer in Oshoogo Nigeria (Oseni et al, 2015)
then Black according to the historic racial classification (Norval et al, 2014). Most published studies from Africa comprise small numbers of individ
groups, with white Europeans forming a significant population in some countries (e.g. 8.8% South Africans). The South African cancer registry
related to the racial (i.e. skin colour) mix. In Africa, Sub-Saharan Africa (SSA) is dominated by Black populations and Northern Africa by Arab ethnic
There are few population-based studies in Africa but skin cancers do appear among the leading cancers. This varies across African countries
major implications for health costs and service provision (Guy et al, 2015).

cancer are treated each year with more new cases than lung, breast, prostate and colon cancers combined. This means that one in five Americans

The electromagnetic spectrum of emissions from the sun produces three wavebands of UVR: UVA (long wave), UVB (medium wave) and UVC (which does not reach the earth's surface). UVB (290-320nm) is the major cause of skin cancer. The level of ozone in the earth’s atmosphere influ
en with how much UVR and UVB can reach the earth’s surface. Ozone holes over South Africa and New Zealand, for example, increase UVB and UVA
the earth's surface and cause easier sunburning. Africa spans latitudes 40oN and 34oS with very high levels of UVR throughout the year. The

cancer. Combined acute intermittent and chronic UV damage induce BCCs. An individual’s response to sunburn and suntan is classified by the Fitzpatrick skin phototype (FSP): initially, types I-V represented white skin and types V and VI were brown and black skin, respectively. This has been modified to include self-reported tendency to burn or tan after sun exposure (Andreaus et al, 1987, Fitzpatrick, 1988) (Table 1).

Table 1: Fitzpatrick Phototype

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<th>Suntan</th>
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The end result of UVR on a skin cell depends on the balance between UVR induced damage and the cell's defence mechanisms. UVB induced
damage with the productions of cyclobutane-pyrimidine dimers and 6-4 photoproducts and characteristic CC-TT mutations in DNA, combines with indirect DNA damage from UVA-induced guanine oxidation products. The mutagenic effects are exacerbated by UV induced

Non-melanoma skin cancers (NMSC) account for three quarters of skin cancers world-wide again with the incidence rising steadily, where this
be ascertained. The majority of NMSCs arise from keratinocytes and so are now being termed keratinocyte skin cancers (KSC) (Figure 1). The
dominant, basal cell carcinoma (BCC), is locally invasive but not metastatic, whereas the cutaneous squamous cell carcinoma (SCC) is both
invasive and potentially metastatic. Although metastasis occurs only in around 5% cases of SCC, this constitutes a quarter of skin cancer
related deaths because of the high number of cases (Kara et al, 2013). Under-recording of non-melanoma skin cancer is a major problem given
the frequency of this tumour group, which is excluded from many cancer registries. However this is undoubtedly the commonest cancer in the
United States and United Kingdom and equal in numbers to the total of other major cancers. Recent estimates suggest that there are probably
around 250,000 NMSC annually across the United Kingdom (Leigh, 2014). In the United States more than 5 million cases of non-melanoma skin
cancer are treated each year with more new cases than lung, breast, prostate and colon cancers combined. This means that one in five Americans
develop a skin cancer in their lifetime. More than 1 million cases of cSCC alone are estimated to occur in the United States per year, which has
major implications for health costs and service provision (Guy et al, 2015).

There are few population-based studies in Africa but skin cancers do appear among the leading cancers. This varies across African countries
related to the racial (i.e. skin colour) mix. In Africa, Sub-Saharan Africa (SSA) is dominated by Black populations and Northern Africa by Arab ethnic
groups, with white Europeans forming a significant population in some countries (e.g. 8.8% South Africans). The South African skin cancer registry
documented 44,176 cases of skin cancer between 2000 and 2004, with the highest incidence in Whites, followed by Coloureds, then Asian/Indian,
than Black according to the historic racial classification (Norval et al, 2014). Most published studies from Africa comprise small numbers of individ
study of skin cancer in Oshoogo Nigeria (Oseni et al, 2015) analysed 98 cases (61% male) and found malignant melanoma, particularly lower limb in men, was commonest followed by cSCC, DFSP and BCC, in that order. This is comparable with figures in other studies (Ochicha et al, 2004; Rafindiddi, 1998). In North Africa, as illustrated in a study from

Figure 1: Melanoma derives from melanocytes in the basal layer and basal cell carcinoma histologically resembles basal keratinocytes. Squamous cell carcinomas also derive from keratinocytes but bear a pathological resemblance to suprabasal keratinocytes. Representative clinical pictures of melanoma, basal cell carcinoma and squamous cell carcinoma.

Egypt, where people of Arab ancestry predominate with brown/olive skin, the picture differs with BCCs being the most common skin cancer, followed by cSCC with melanoma uncommonly (Kusse, 2005). It was estimated that 60% of the risk of developing NMSC could be attributed to sun exposure and 45% to skin colour (El Khwsky et al, 1994).

Role of Ultraviolet Radiation (UVR)

The end result of UVR on a skin cell depends on the balance between UVR induced damage and the cell’s defence mechanisms. UVB induced
damage with the productions of cyclobutane-pyrimidine dimers and 6-4 photoproducts and characteristic CC-TT mutations in DNA, combines with indirect DNA damage from UVA-induced guanine oxidation products. The mutagenic effects are exacerbated by UV induced

Other Harmful Effects of Sun Exposure

Sunburn is the best known acute effect of sun exposure (Kennedy et al, 2003) and although white skin is at greatest risk, it can be experienced by those with pigmented skin (Batte et al, 2013): 42% of 11-14 year olds with brown/black skin surveyed in a South African school had experienced sunburn the previous year (Wright et al, 2015). Photo-conjunctivitis and photo keratitis are also prevalent due to sunburn of the eye and eyelids. Chronic ocular UVR exposure can cause a pterygium (wing shaped growth) of the conjunctiva, which can grow over the cornea and impair vision.

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The end result of UVR on a skin cell depends on the balance between UVR induced damage and the cell’s defence mechanisms. UVB induced
damage with the productions of cyclobutane-pyrimidine dimers and 6-4 photoproducts and characteristic CC-TT mutations in DNA, combines with indirect DNA damage from UVA-induced guanine oxidation products. The mutagenic effects are exacerbated by UV induced

Other Harmful Effects of Sun Exposure

Sunburn is the best known acute effect of sun exposure (Kennedy et al, 2003) and although white skin is at greatest risk, it can be experienced by those with pigmented skin (Batte et al, 2013): 42% of 11-14 year olds with brown/black skin surveyed in a South African school had experienced sunburn the previous year (Wright et al, 2015). Photo-conjunctivitis and photo keratitis are also prevalent due to sunburn of the eye and eyelids. Chronic ocular UVR exposure can cause a pterygium (wing shaped growth) of the conjunctiva, which can grow over the cornea and impair vision.
This can progress into an SC of coma or conjunctiva (SCC) especially in dusty environments, in outdoor workers or those with HIV infection. UV is also a major cause of cutaneous cancers, which begin earlier in life in Africa and contribute to the high levels of blindness in SSA (20% world blindness).

**Beneficial Effects of Sun Exposure**

Apart from reported benefits of well-being from holidays in the sun, ultraviolet B radiation is a major source of vitamin D in the skin. Recent attention has focused on the association between low vitamin D concentrations and many disorders, such as cancer, cardiovascular disease, autoimmune disease, dementia and diabetes (Audet et al, 2012; IARC, 2008). Observational studies suggested that high serum levels of vitamin D might be protective but randomized controlled trials have failed to support this and suggests that low vitamin level D is a result rather than cause of ill health. There has been significant adverse publicity to sun avoidance campaigns but evidence is still needed that increasing vitamin D levels decreases the risk of cancer given the well-established link of skin cancer risk and ultraviolet radiation. Endogenous vitamin D production occurs rapidly on UVB exposure: maximum pre-vitamin D3 in white skin can be produced in 5-10 minutes of UVB exposure to face and forearms on a sunny day two or three times a week (Gilchrest, 2008). Thus there is currently no justification for altering sun avoidance advice nor routine supplementation with vitamin D.

**Skin Colour and Susceptibility to Skin Cancer**

Skin colour is determined by the number and activity of melanocytes, which live in the basal layer of the skin. They transport the pigment melanin in packages called melanosomes along their long dendritic processes into adjacent keratinocytes to color their nuclear DNA. There are two types of melanin: the black-brown eumelanin and the yellow-red phaeomelanin. As melanin helps to protect the skin cells from UV damage and provides a sun protection factor of 13.4 in black compared to white skin. This is why white skinned individuals have the highest rates of skin cancer of all racial groups. There are many rarer cancers of the skin such as Merkel Cell-Carcinoma and dermatofibrosarcoma protuberans, which are not considered further.

**Genes Involved in Skin Colour**

Cloning of the MC1R revealed an association between MC1R variants and red hair, blue eyes and fair skin (particularly Arg151Cys, Arg160Trp and Arg294His (Binstock et al, 2014). When MC1R signalling is inactive there is lower melanin production in skin and a tendency to phenomelanin pigmentation in hair. MC1R variants are common in African and African populations and are also found prominent variants within populations with high frequency (79%) of Ag163in in East and Southeast Asian populations and Amerindians but with a lack of variation from the consensus sequence in African and Indian populations (Rana et al, 1999). This fits with a theory that as populations migrated out of Africa to areas of lower UVR exposure, dark skin was a disadvantage because reduced vitamin D was synthesised in the skin and therefore lighter skin colour had a selective advantage (Cavalli Sforza et al, 1994). Other polymorphisms in genes that affect skin colour include POMC, ASP, KITLG, SLC24A5, TYR, TYRP1, HIRB1, OC123 and HFE. MC1R variants are also associated with an increased skin cancer risk for both cutaneous melanoma (15% cases) and keratinocyte skin cancers. These variants increase the risk of UV induced skin cancer as phaeomelanin is less protective than eumelanin. However impaired MC1R function not only affects pigmentary mechanisms but also non-pigmentary mechanisms (reduced DNA repair and effects on cell proliferation and immune function).

**Other Risk Factors for Skin Cancer**

Patients on long term immunosuppressive drugs for organ transplantation (organ transplant recipients (OTR)) are at greatly increased risk of cSCC (up to 150 fold) with a reversal of the usual BCC:cSCC ratios (1:5) (Harwood et al, 2013; 2016). This also affects those who receive long term immunosuppressive drugs for immune mediated disorders, such as inflammatory bowel disease and rheumatoid arthritis. In addition to effects on immune function, some drugs have direct carcinogenic effects, such as azathioprine, which predisposes to UV oxidative damage. Where a disease process results in immune dysfunction, such as chronic lymphoid leukaemia, skin cancer can also be a problem. A possible role for beta and gamma papilloma viruses has been extensively examined in OTRs (Bouwes Bavinck et al, 2010) and much is being established about the molecular mechanisms of skin cancer in such patients (Harwood et al, 2016). This is an obvious paradigm for untreated HIV infection. Other risk factors for skin cancer include exposure to chemical carcinogens, notably arsenic in ground water, previous exposure to ionising radiation and chronic inflammation or injury to the skin such as thermal burns; chronic ulcers; scarring discoid lupus erythematosus; recessive dystrophic epidermolysis bullosa; graft versus host disease, and lichen planus.

**Genetic Susceptibility to Skin Cancer: Syndromes Important in Africa**

There are a number of genetically determined syndromes which predispose to skin cancer of particular importance in the African context: ocular diseases; graft versus host disease, and lichen planus.
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Chapter 14 – African Skin Cancer

Africa: Skin Cancer

Common. The regional dermatology training school in Moshi, Northern Tanzania (RTDS), supported by the International League of Dermatology Societies (ILDS) and the International Foundation for Dermatology (IFD) has had an established programme of cancer prevention and treatment for Albinos since 1993, in Northern Tanzania (Lookingbill et al, 1995) where the prevalence is estimated to be 1 in 2,500. A retrospective study of 134 biopsies from 86 patients showed head and neck tumours in 56% and cSCC was the commonest cancer (53.7%) with only one case of melanoma. Patient outcome is affected by a delay in seeking medical care 14.4 months in comparison with 26 months in Nigeria (Yakubu et al, 1995). African albinos living with stigma of the disease present late and have a poor prognosis (Cruz-Inigo et al, 2011; Hong et al, 2006; Lund et al, 2002). Also many patients do not complete their treatment for financial or geographical reasons (Mabula et al, 2012).

Xeroderma Pigmentosum

Xeroderma pigmentosum (XP) where DNA repair is impaired following UV, is caused by mutations in 8 genes encoding proteins involved in nucleotide excision repair pathways. As it is an autosomal recessive inherited disease, it is commoner in communities with high levels of consanguinity and is a particular problem in Northern Africa and the Middle East. There are 7 subgroups with distinct clinical features. Children develop severe sunburn reactions in childhood and have multiple skin cancers from an early age with a 100 fold increased risk for skin cancers in sun-exposed sites compared to the general population (Figure 2). The average age of onset of NMICS is aged 7-8. The patients also have irregular freckled pigmentation and photophobia. Patients are also at increased risk of internal malignancy: lung, breast, pancreas, gastric and brain cancers. Some subgroups have ophthalmic and neurological abnormalities in addition.

Clinical Picture of Skin Cancer in Pigmented Skin

The site of cSCC is in the head and neck region in Albinos (Asuquo et al, 2010) but although cSCC is the commonest form of skin cancer in non-Albino Africans, the commonest site is not the head and neck but mainly on the legs (as well as anogenital area). Thus it seems less associated with UV exposure and the main risk factors are chronic scarring or inflammation such as burn scars and chronic non-healing ulcers. Chronic inflammation such as lupus erythematosus or leprosy can also be predisposing factors. These cSCCs can be aggressive with a high tendency to metastasis (up to 30%). In contrast BCCs are mainly found in sun-exposed sites. The clinical presentation of melanoma is also distinctive in Africans with a high proportion of acral lentiginous melanomas on the palms, soles or under the nails. They also occur in the lining of the mouth.

Figure 2: Left: Cutaneous squamous cell carcinoma in African Albino. Right: Multiple tumours in a child with xeroderma pigmentosum

Oculo-Cutaneous Albinism (OCA)

There are 5 types of oculo-cutaneous albinism: the commonest being OCA1 and 2. Affected individuals have a light skin tone but may develop freckles and fleshy pink moles on sun exposure. Their hair colour varies from white to light brown but tends to be yellow or reddish in Africans. The eye colour also varies from very light blue to darker but may appear red or pink due to reflection from the retina. This lack of pigment causes photosensitivity and is always associated with effects on vision such as nystagmus, strabismus and amblyopia.

OCA1, the most frequent variant, is caused by a mutation in the tyrosinase gene (TYR) which means that no or very little melanin can be synthesized. Affected individuals have milky skin, white hair and blue eyes but skin can darken with age. The frequency of this type of albinism is 1/40,000 worldwide (Gietling et al, 1993).

OCA2 occurs most often in sub-Saharan Africa, African-Americans and Native Americans with a similar clinical picture to OCA1. OCA2 is therefore the most common form affecting Black South African albino (1 in 3,900) but the prevalence is estimated to range from 1 in 15,000 in the East-Central State of Nigeria (Okoro, 1975) to 1 in 1,200 in the Tonga tribe of Zimbabwe (Lund et al, 1997).OCA2 is caused by mutations in a “p” protein which is involved in several aspects of melanin production (Stevens et al, 1995). Although eumelanin cannot be synthesized by affected skin, phaeomelanin may be produced with age.

The OCA3 (mostly black South African) and OCA4 (Mostly East Asian) variants are due to mutations in genes for tyrosinase related protein 1 (TYRP1) and membrane associated transport protein (MATP) respectively. The search for the other OCA genes is ongoing. OCA particularly predisposes to squamous cell carcinoma of the head and neck, which is aggressive and has a high rate of recurrence (de Vijlder et al, 2013). The risk of cSCC in Black albinos is 1000 times the risk in the general population and usually occurs by the age of 30 with a late presentation and poor prognosis (Luande et al, 1985). Head and neck cSCCs are commoner than BCCs and melanoma is relatively rare. Actinic cheilitis and lip cancers are also.
Emerging Problems with Skin Cancer in Africa: Melanoma and Non-Melanoma Skin Cancer

HIV infection has been associated with malignancies, in particular Kaposi’s Sarcoma, non-Hodgkin’s lymphoma and invasive cervical cancer, which are termed AIDS defining cancers. However other non-AIDS defining cancers in HIV infected persons have been identified (Shiels et al, 2009). OTRs have been documented to have a greatly increased risk of skin cancer, particularly 100 fold increased risk of CSCC and oncogenic HPV driven anogenital cancer is also a clinic problem (Harwood et al, 2016). It might be surmised that HIV-seropositive patients might have an increased risk of skin cancer compared to HIV seronegative populations. CSCC has been found to be higher in HIV patients in the United States (aOR 2.695%CI 2.1-3.20) with a trend to association with lower CD4 counts (Silverberg et al, 2013). A recent study from West Africa systematically screened the prevalence of HIV defining and non-defining cancers in 184 HIV infected cancer patients. In addition to the well-established AIDS defining cancers, a strong association was found with anogenital cancer (aOR 17.7 CI: 17.3-99.8) and CSMC (aOR 5.2 CI: 1.2-22.3). This supports a strong association between HIV and HPV associated cancers (De Vuyst et al, 2009; Jaquet et al, 2013). CSCC of the lip is also increased in HIV-positive immunosuppressed patients compared to HIV sero-negative individuals (Frisch et al, 2001; Grulich et al, 2007) which could also implicate HPV.

Anogenital Cancer

The identification of high risk human papillomavirus (HPV) types as causative in anogenital (and oropharyngeal cancers) led to development of preventive vaccines against HPV16 and 18, but global availability of such vaccines would require a major lowering of costs. Anogenital cancer (and HPV) in SSA rightly focuses on cervical cancer as being the most common cancer in women (De Vuyst et al, 2013), and there is a dearth of data on anal, penile or vulvar cancers, which are strongly linked with high risk HPV in the rest of the world. Penile cancer is uncommon in developed countries but is common in East Africa (Curado et al, 2007). Multiple HPV genotypes are common in precancerous lesions in HIV infected populations, both carcinogenic and non-carcinogenic (Clifford et al, 2006). Genital warts caused by HPVs 16 and 11 are also commonly found in Africa (Banura et al, 2013) with aetiological association with anogenital cancers. Genital warts are also found more commonly in HIV positive women than HPV negative. The prevalence of anogenital warts in SSA was subject to a systematic review (Banura et al, 2013) in high risk individuals and ranged from 3.3% to14% across African Regions in women and 3.5%-7% in men. The prevalence rates were therefore significantly higher in HIV+ women and the incidence rate was higher in uncircumcised than circumcised men.

Sun Protection and Skin Cancer Prevention in Africa

Public health initiatives aim to reduce the incidence of skin cancer and to detect and treat lesions early before invasion and metastasis can occur, as effective treatment options are then very limited. The main thrust is to avoid sun exposure from early childhood (Table 2). These measures include:

- Shade and reduction of outdoor activities at times of peak UVR. Direct sunlight between 10:00 and 15:00 should be avoided by staying in the shade (trees or buildings) or under an umbrella. This is just as important on overcast days.
- Protective clothing including hats. Wide brimmed hats and loose fitting tight weave clothing are the best protection. In some African countries traditional dress involves full body coverage and headgear varies regionally but may provide good protection.
- Sunscreens. A sun protection factor (SPF) is the amount of protection obtained by applying a specific sunscreen (or other intervention) and reflects the number of times the intervention extends the time taken for the skin to burn (minimal erythema dose: MED). If the skin turns red with 10 minutes exposure, then an SPF of 10 extends this to 100 minutes. However these figures generated in testing sunscreens don’t translate to real life where sunscreens is often applied in a much thinner layer. Topical sunscreens are widely used in high resource countries when a sunscreen with a Sun Protection Factor (SPF) of a minimum of 20 and not higher than 50, should be applied to all exposed skin areas. However these preparations are very expensive and therefore unrealistic for low and medium resource countries. In some countries, such as South Africa, sunscreen is available for albinos from government or charitable resources. The RDTS programme in Moshi manufactures its own low cost sunscreen. Traditional African skin clays may provide some sun protection in some communities (Oliva et al, 2013)
- Sunglasses. To prevent the eye complications of excessive UVR, eyes should be protected by wearing sunglasses with a UV protection rating of UV400. This is also not economically feasible for the majority of people living in Africa but sunglass usage, largely seen as a fashion item, has not been systematically assessed in Africa (<20% in Morocco).
- Sunlamps and tanning parlours should be totally avoided.
- Children need special protections - babies younger than one year should never be exposed to direct sunlight.

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Figure 3: Typical presentations in Africa of melanoma and cutaneous squamous cell carcinoma: acral lentiginous malignant melanoma, invasive melanoma and cutaneous SCC on foot in Black skin.
School Based Teaching About Sun Safety and the Risks of UVR

The WHO recommends implementation of sun-protection practices in schools, such as the Sunsmart School Accreditation Programme (SSAP) operating in Australia (Dobbingson et al, 1998) which has increased availability of physical sun protection at school and improved the use of hats, clothing and shade. An exploratory study in South Africa by the Cancer Association of South Africa (Cansa) showed that despite urban govern-

Table 2. Sun avoidance and skin cancer prevention: key messages

- Sun protection is important for all skin types.
- Use a sunscreen daily and gently after each application.
- All skin types can be exposed.
- Sun exposure above the capillaries.
- Seek early advice for suspicious lesions.
- Seek shade from 11 am to 3 pm.
- Wear a sunhat, T-shirt and sunglasses.
- Cover up with a hat, T-shirt and sunglasses.
- Use a sunscreen daily and gently after each application.
- All skin types can be exposed.
- Sun exposure above the capillaries.

Metastatic melanoma also has a very poor prognosis and until recently this was also the case in high resource countries. However under-

Early Diagnosis and Skin Screening

A good outcome from all skin cancers depends on early diagnosis, which has led to many public campaigns and also to the suggestion that skin screening should be considered. Skin cancer screening has been proposed to recruit healthy individuals to examine their whole skin. European opinion has been influenced by a population based skin screening project (SCREEN) which was undertaken in Schleswig Holstein by trained non-dermatologist observers. Although a 50% reduction of mortality was claimed after 5 years, there were significant methodological concerns regarding historic non-screened controls and an apparent short term benefit which was not sustained (Brettart et al, 2012). There is currently no support for the effectiveness of population-based measures for early detection of skin cancer although patients are at increased risk of skin cancer for hereditary (familial cancer) or acquired reasons (immunosuppression, age) need increased surveillance. False positives lead to unnecessary surgery and scaring as well as being a cause of anxiety and stress. Skin cancer education campaigns such as Euromelanoma and “melanoma days” raise the awareness of skin cancer and may increase case numbers but the ratio of interventions to accurate diagnosis can be low (Waldmann et al, 2012) and adequate resources need to be available to deal with the aftermath of such campaigns. There is no role for skin screening in Africa but there is a need for education to enhance early detection.

Early Diagnosis and Chemoprevention

In the early stages, both melanoma and NMSC are confined within the epidermis, called the melanoma in situ and the carcinoma in situ, respec-

Preparation of this chapter has been supported by a Fellowship to iPRI from the British Association of Dermatology.

Acknowledgements

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Biobanking and its associated policies and procedures for managing biological specimen collections are critical to the success of a variety of research endeavors. Several international organizations have produced best practices which cover the important technical and ethical-regulatory issues that are important for the collection and management of biospecimens and associated data. The expanding and global nature of biomedical research has resulted in disparities in biobanking practices among high-income countries (HIC) and low- and middle-income countries (LMIC). In Africa, projects such as H3Africa and B3Africa have resulted in new and promising advances in biobanking infrastructure and the creation of biobanking networks. However, the initiation of such projects has highlighted some of the challenges faced by biobanks in Africa, from both the technical and ethical-regulatory perspectives.

Introduction to Biobanking

Biobanking involves the collection, processing, storage and use of biological specimens for research purposes. For the purpose of this chapter we will generally concentrate on biospecimens collected for research into the etiology, diagnosis and treatment of cancer, although most of the issues discussed apply to infectious disease biobanking efforts as well. Historically, early biobanks emerged from the collection of samples by surgeons and pathologists for diagnostic purposes. Thus, the earliest biobanks evolved from collections housed in pathology departments. In the United States, the Armed Forces Institute of Pathology (AFIP) collection was initiated during the American Civil War (Armed Forces Institute of Pathology, 2016). A similar example in Africa is the Kampala Cancer Registry (KCR), which is situated in the Department of Pathology, School of Biomedical Sciences, Makerere University College of Health Sciences and has maintained tissue samples collected for diagnosis dating back to 1954 (Doll et al, 1982).

Biobanks may be small collections within a pathology laboratory, a few freezers in a basic or clinical research department, or a large government or commercial operation with hundreds of freezers and millions of biospecimens (Vaught, 2016). Biobanks may house tissues in the form of formalin-fixed, paraffin-embedded blocks or in the frozen state. Fluids such as blood and blood fractions (serum, plasma, and buffy coat), urine and saliva are also collected. The type of biospecimens collected and the processing and storage conditions chosen by researchers depend on...
the intended analyses, e.g. for cancer biomarker development ( Hewitt et al, 2012 ). Pre-analytical variables such as ischemic time, freeze-thaw cycles and other factors may affect the quality of the samples and result in misleading laboratory data ( Vaught, 2015 ). The field of “biospecimen research” has emerged to study and mitigate such pre-analytical factors ( Moore et al, 2011 ).

As biobanking has grown and expanded globally, a general trend toward “professionalization” has emerged. Organizations such as the International Society for Biological and Environmental Repositories (ISBER, 2016), the European, Middle-Eastern and African Society for Biopreservation and Biobanking (ESBB, 2016), the Biobanking and BioMolecular Resource Infrastructure (BBMRI-ERIC, 2016) and Biobank Cohort Building Network (BCNet, 2016) initiatives are all promoting biobanking education, standards development and research. Graduate level biobanking degree programs will result in a new generation of biobankers. Before these developments over the past 20 years, biobanking was a secondary career for pathologists and other research professionals who created and operated biospecimens, and developed practices on an empirical basis to fit their needs.

The trends toward more organized and professionally-managed biobanks have created new opportunities for international cooperation and collaboration (Vaught et al, 2014a). However, such international collaboration requires standardization for collecting and exchanging biospecimens and data (see next section, Biobanking Best Practices). In addition, the larger biobanks now usually will benefit from developing a business plan and a strategy for long-term sustainability, i.e. in the event of funding limitations (Vaught et al, 2011). In terms of the technical aspects of biobanking, emerging technologies for collecting, processing and storing samples need to be followed closely, as the success of a research project may depend on developing new evidence-based practices (Engel et al, 2014; Vaught, 2016). Even more difficult to manage are the ever-changing ethical and regulatory aspects of biobanking, including informed consent, privacy, intellectual property and sample and data access policies (Forberg et al, 2009; Office of Human Research Protections, 2016; Vaught et al, 2007).

A reform of the European General Data Protection regulation (GDPR) has been proposed and discussions at the European Trilogy (Parliament, Council and Commission) are ongoing. The reforms aim to strengthen and unify data protection for individuals within the European Union (European Data Protection Reform, 2016). The GDPR also addresses export of personal data outside the EU which poses more challenges that will need to be managed by biobanks.

A “Q & A” article in Clinical Chemistry in 2014 (Vaught et al, 2014b) outlined “Critical Issues in International Biobanking,” including: quality management, sustainability, centralized versus distributed biobanks; communicating the value of biospecimens; data sharing; and the management of return of research results and incidental findings (see Challenges to Biobanking in Africa). As discussed in the following sections, such issues are not unique to biobanking in Africa, but are among the challenges that must be managed for the long-term success of biospecimen-based research on the continent.

Biobanking Best Practices

As mentioned in the last section, as biobanking has grown into a global enterprise, it has become necessary to develop best practices to control the technical and ethical-regulatory aspects of biospecimen management. Prior to the publication of such best practice documents, it was customary in biobanks as well as, for example, pathology laboratories, to develop biospecimen collection, processing and storage protocols to fit local needs. However, as problems emerged with sample and data exchange among collaborators, a number of international organizations published best practices, which have been widely adopted over the past 15 years. Among the organizations which have led in developing such documents are IARC (International Agency for Research on Cancer, 2016; vaught et al, 2012); ISBER, OECD and others. Several comprehensive reviews have outlined the evolution of such guidance documents (Vaught et al, 2012; Vaught et al, 2010).

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Biobanking best practices are generally divided into technical and ethical-regulatory (also referred to as ELSI or ethical, legal and social issues) recommendations. The list below shows the table of contents from the U.S. National Cancer Institute Best Practices for Biological Resources (U.S. National Cancer Institute Best Practices for Biological Resources, 2016):

The following shows the major contents headings from the U.S. National Cancer Institute Best Practices for Biospecimen Resources

- A. Scope, applicability, and implementation
- B. Technical and operational best practices
  - B.1. Biospecimen resource management and operations
  - B.2. Biospecimen collection, processing, storage, retrieval, and dissemination
  - B.3. Quality management
  - B.4. Biosafety
  - B.5. Collecting and managing clinical data
  - B.6. Biospecimen resource informatics: data management and inventory control and tracking
- C. Ethical, legal, and policy best practices
  - C.1. Principles for responsible custodianship
  - C.2. Informed consent
  - C.3. Privacy and confidentiality protections
  - C.4. Access to biospecimens and data
  - C.5. Intellectual property and resource sharing
  - C.6. Conflicts of interest

Informatics: The Electronic Glue of the Biobank

(Reprinted from Vaught, 2016)

Biobanks are dependent on information systems for a number of critical functions. At every step of the processes of receiving, shipping, collecting, processing, storing and retrieving specimens from storage, the samples must be accurately tracked, with every movement and process recorded. Chain of custody is an important concept in biobanking. Bar coding or RFID tracking are necessities. Freezer inventory systems are necessary to maintain up to date information on all steps of storage and retrieval. Laboratory information management systems (LIMS) have been adapted to biobanking applications and have been widely adopted.

The annotation of specimens with clinical, demographic and analytical, as well as sample handling data, contribute to their long-term value. Standards for collecting and transmitting specimen data are critical to the biobank’s success. Developing a minimal set of data elements for each biospecimen research project should be an early step in project planning. There are some issues which must be resolved in order for biospecimen research collaborations to be successful. Often informatics systems developed for one institution cannot communicate with other institutions without the development of an interface to allow the systems to be interoperable. Biobanking best practices provide general guidance on overcoming such obstacles.

Informatics: The Electronic Glue of the Biobank
A special aspect of biobanking that has emerged over the past few years is the importance of developing strategic and business plans, and planning for the long-term sustainability of the operation (Henderson et al, 2013; Vaught, 2013). During economic downturns and in particular for biobanks in low resource countries it is important to develop such plans. Recommendations related to business plans and sustainability have appeared in a number of editorials and review articles (Vaught, 2013; Vaught et al, 2011).

**Biobanking in Africa: Examples of Projects**

The chapter by Mendy et al. in the Handbook for Cancer Research in Africa (Rebbeck, 2013) noted the following:

"The global total of new cancer cases is projected to increase by 60% to 21 million annually by 2030, with an estimated 13.1 million deaths from cancer yearly. About half of these cancer deaths will occur in low-income countries and more than 80% of these in African countries."

Given biobanking's central and critical role in basic, translational and clinical cancer research, developing workable standards for biospecimen management in African countries is necessary. Early biobanks in Africa were developed due to the need to collect samples during the AIDS epidemic (Mendy et al, 2014). More recently the Ebola epidemic in western Africa led to additional biobanking needs. Thus much of the early and current biobanking activities in Africa have resulted from the spread of emerging infectious diseases, as well as more long-term issues concerning tuberculosis and malaria (Mendy et al, 2014).

An example of an institution in Africa that had adopted biobanking as a research platform since the early 1970s is the Medical Research Council Unit in The Gambia West Africa (The Gambia West Africa Medical Research Council Unit, 2016). The MRC Biobanks have biospecimens collected for research on infectious and chronic diseases since the early 1970s and has provided the facilities for one of the first national DNA bank in Africa (Singuo et al, 2004).

Recently two projects have been funded which will result in additional progress in biobanking and research infrastructure in Africa: H3Africa (Human Health and Heredity in Africa, 2016) and BiAfrica (Bridging Biobanking and Biomedical Research across Europe and Africa, 2016). The H3Africa program, jointly funded by the Wellcome Trust and the U.S. National Institutes of Health (NIH), will study the genomic and environmental determinants of a variety of diseases (Human Health and Heredity in Africa, 2016). The program required the development of a biobanking network among several African countries. A review by Abayomi et al. noted that developing harmonized technical and ethical standards among the network’s partner was a challenge. In general, the lack of biobanking standards and infrastructure in Africa slowed the initial progress in developing the H3Africa network (Abayomi et al, 2013).

BiAfrica (Bridging Biobanking and Biomedical Research across Europe and Africa project, funded by BBMRI-ERIC (Bridging Biobanking and Biomedical Research across Europe and Africa, 2016), aims to “implement a cooperation platform and technical informatics framework for biobank integration between Africa and Europe. The collaboration harmonises the ethical and legal framework, biobank data representation and bioinformatics pipelines for sharing data and knowledge among biobanks and allowing access for researchers from both continents.”

**Challenges to Biobanking in Africa**

Projects such as H3Africa and BiAfrica will result in improved conditions for biobanking and biospecimen research in Africa. However, currently the situation in Africa and among LMICs elsewhere is indicative of the challenges faced in such countries. In a survey conducted by IARC among LMICs in Africa, Asia and Europe (Mendy et al, 2014) it was determined that although there were some exceptions, in general biobanking in LMICs were lacking in the technical and ethical regulatory standards and infrastructure practiced in HICs.

In terms of technical issues, many of the challenges to successful biobanking among LMICs in Africa relate to infrastructure. The availability of up to date processing and storage equipment is sometimes lacking. If the equipment is available then other issues may interfere with its proper use, such as intermittent power outages (Abayomi et al, 2013). As noted by Fleming (2013) in “State of Oncology 2013” (Boyle et al, 2013), there is also a shortage of trained pathologists in LMIC, which presents a major obstacle to collecting high-quality samples and otherwise developing well-managed biobanks. The problem is particularly acute in sub-Saharan Africa. The shortage of pathology services not only affects the ability to collect samples for biobanking. The quality of patient care is also affected in that these issues are often not collected for diagnostic purposes.

Biobank sustainability is also an issue among African biobanks, as it is among all LMICs. Even among more well-developed biobanks in developed countries, biobanks are generally not self-sustainable without significant contributions from government and/or institutional sources (Henderson et al, 2013; Vaught, 2013).

As noted by Abayomi et al. (2013), ethical, legal and social issues have been difficult to coordinate and harmonize for biobanking initiatives in South Africa, which has a relatively well-developed research infrastructure. For LMICs in Africa the situation is even more complicated. As noted by Mendy et al (2014) in an assessment of biobanking practices in 26 LMIC centres:

"ELSIs are dealt with by various mechanisms in the different ethics and scientific committees in more than 90% (24/26) of the centres. These committees are responsible for reviewing and approving research activities. However, ELSIs specific to biobanking or biobank projects are usually not included in the committees' review processes, and this is an important challenge in biobank governance in LMIC. For example, most centres do not have patient-consent procedures for the systematic storage of post analysis clinical samples for future research. Informed consent is project-specific, and broad consent, which would enable efficient use of biobanking resources, is not usually obtained from participants."

Going forward, African biobanking practice is expected to improve as the public and researchers become more educated in best practices (next section, Biobanking Educational efforts in Africa), and biobanking networks are further developed to support multi-country projects.
Biobanking Educational Efforts in Africa

In addition to biobanking infrastructure issues which are inhibiting research progress in LMICs, there is a general lack of biobanking knowledge among the public and researchers. A number of international organizations have increased their efforts to identify issues and conduct workshops to increase awareness and provide training opportunities.

- **IPRI**: As noted in its mission statement, IPRI has “the broad goal of contributing to the improvement of health in populations worldwide”, and “aims to increase prospects for prevention through training, education, prevention research and research into causes worldwide with a focus on low and lower-middle income countries.” For a discussion of biobanking in Africa, two chapters from the IPRI book “State of Oncology 2013” (Boyle et al, 2013) are instructive: “Lack of Pathology in Low Income Countries” (Fleming, 2013), and “Biobanks: Central Importance and Standards” (Pasterk et al, 2013). In addition, IPRI hosts an annual National Cancer Institute Directors conference, where participants from multiple LMICs, including Africa, meet to discuss their research initiatives and challenges.

- **IARC**: IARC has supported biobanking activities for many years, including the European Prospective Investigation into Cancer (EPIC) (EPIC, 2016), which involved creating a biobanking network centered in Lyon and involving multiple sites in Europe. As noted above, IARC investigators have published a number of articles concerning biobanking operations and challenges in LMICs, including Africa (Mendy et al, 2014; Rebeck, 2013).

- **BCNet**: BCNet is the LMIC Biobank and Cohort Network, and is a cooperative effort among IARC, the U.S. NCI Centre for Global Health and other international partners. BCNet has engaged in a number of training efforts in LMICs and has recently partnered with ISBER to provide online training for ISBER’s Best Practices (ISBER, 2016).

- **BBMRI-ERIC**: BBMRI-ERIC supports biobanking educational activities through its annual Hands On Biobanking conference (BBMRI-ESBB HandsOnBiobank, 2016), and has recently partnered with ESBB to host annual biobanking meetings.

- **ISBER**: ISBER’s Best Practices are available on the Society’s website, and ISBER has developed a Regions program, which includes organizing biobanking efforts in the Europe, Middle East and Africa (EMEA) Region (ISBER Strategic Plan 2014-2017). ISBER’s annual meetings attract members from Africa as well as participants from multiple countries.

**Conclusions and Future Directions**

With the recognition that standardized biobanking infrastructure and practices are critical to the success of basic, translational and clinical research, and that international collaboration is now the norm, biobanking in LMICs and elsewhere will begin to become more in line with practices in HICs. However, there are a number of challenges that LMIC biobanks will need to overcome.

The following are some of the current trends and ongoing biobanking challenges in Africa:

- Other than large projects such as H3Africa and BiAfrika, government and institutional support for biobanking will be necessary for long-term sustainability.

**REFERENCES**


As with cancers everywhere, African cancers deserve to be prevented, to be treated, to be cured and to be palliated. If we don’t do it now, starting immediately, it will be too late and Africa’s cancer crisis will continue to grow out of control.”

Professor Peter Boyle, 2015
There are many reasons to do the right thing in life. Few are more important than providing our children with the hope that their lives will be better than their parent's. Our hope is that, as regards cancer in Africa, the next generation will have it better.
Invitations were sent to Oncologists in many countries of Africa to describe the current State of Oncology in their country. This section presents the responses. Each invitation requested some basic information and they invited the author to attach his or her personal observation following this. The resulting chapters are variable but present a broad picture of the current State of Oncology in Africa, as seen from an African perspective.
Chapter 16a

Angola

Fernando Miguel, António Armando


Malignant neoplasms (cancers) are a group of over 100 diseases characterized by rapid cell proliferation of an organ’s tissues. The clinical presentation of cancers consists of nodules or tumours affecting adjacent organs and developing local or distal metastases. (Merlo et al., 2006)

According to the World Health Organization (WHO), cancer is a worldwide public health problem. In 2012, cancer incidence and mortality were estimated at 14.1 million new cases and 8.2 million deaths. Approximately 32.8 million people were living with the disease after 5 years of diagnosis. (Ferlay et al., 2013) Projections based on these estimates suggest that there will be about 19.3 million new cases in 2030. (Ferlay et al., 2013)

The most prevalent types of cancer are lung cancer (1.8 million, 13%), breast cancer (1.7 million, 11.9%), and colorectal cancer (1.4 million, 9.7%). (Ferlay et al., 2013) However, the distribution of cancer in the world is heterogeneous.

In developed countries, most cases of cancer affect the following organs: lung, breast, prostate, colon and rectum, and endometrium; in addition, neoplastic diseases are the second leading cause of deaths for disease. (Ferlay et al., 2013)

In developing countries, the most common types of cancer are uterine, stomach, liver, and oral cavity cancers, as well as Kaposi’s Sarcoma. In these countries, neoplastic diseases are not among the leading causes of death because infectious diseases are the main health problems. (Boyle et al., 2008)

Whereas in developed countries only 10% of cancers are associated with biological agents and more than 60% of patients are diagnosed at an early stage of the disease; in low-income countries it is the opposite. In these countries, more than 25% of cancers are linked to infectious agents and 80% of patients are diagnosed at an advanced stage of the disease. (Boyle et al., 2008; Ferlay et al., 2013)

In spite of such data, the extent of cancer has not been determined in developing countries such as Angola. Deficit of qualified professionals and shortage of diagnostic resources and Population-Based Cancer Registries are suggested to be the main causes of this lack of knowledge on cancer cases. (Parkin et al., 2003)

“How is it acceptable that over half the countries in Africa do not have radiotherapy machines? As intolerable, how can over half the countries in Africa outlaw the use of medical morphine leaving thousands to die in pain?

Where is our sense of humanity?”

Professor Peter Boyle, 2015
Since the 1970s, there has been a growing trend of cancer incidence and mortality; therefore, in the 1980s, the WHO started to recommend that every country in the world, even those showing low incidence and mortality rates, should design and implement Cancer Prevention and Control Programs. (WHO, 2002)

The estimated population growth and the increased number of elderly related to higher exposure to the risks of developing malignant neoplasms contributed to increasing both cancer incidence and mortality. Thus, a well-planned cancer control program will contribute to reducing the negative impact of the disease and improving the rational allocation of scarce resources. (WHO, 2002)

A guide to help countries with the preparation and implementation of Cancer Prevention and Control Programs was published in 2001 and updated in 2002 by the WHO. Additionally, in 2010, the WHO also published a series of six modules on the same topic. (WHO, 2006, 2007a, b, c, 2008a, b)

With the purpose of adapting these guides to the African context, the WHO African Region published a guide for health policy maker in 2012. In 2013, the Union for International Cancer Control (UICC) published a checklist for implementation of a National Cancer Control Program. In 2012, the WHO African Region published a guide for cancer control in Africa. (WHO, 2012)

According to the WHO, a Cancer Prevention and control Program consists of a set of public health measures focused on reducing cancer incidence and mortality and improving patients’ quality of life. This can be achieved through the implementation of systematic and equitable evidence-based strategies aimed at primary prevention, early diagnosis, curative and palliative care, and rational use of the available resources (WHO, 2002).

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Health Care in Angola

Angola is located in Southern Africa. Its surface is 1,246,700 km² and its estimated population is over 23 million inhabitants (INE, 2015) (Figure 1).

After becoming an independent country in 1975, Angola endured a civil war that lasted for 27 years. This conflict resulted in the destruction of a great part of the country’s infrastructure and had devastating socioeconomic consequences with a negative impact on the health status of the population.

After peace was established in 2002, the Angolan government drew up an action plan to improve the socioeconomic conditions of the population. Health was a key concern considering that a population with good health status is essential for the country’s development (Angola, 2010).

However, it was necessary to design a National Health Policy setting out the strategies to improve the health care provided to Angolans. In order to fulfill this objective, the Angolan Ministry of Health started working on a policy that was approved and published in November 2010.

With the purpose of implementing the National Health Policy, the National Health Development Plan - NHDP was approved in 2012 (Angola, 2012). This plan was prepared by a multisectoral committee established by the Presidential Office by the Order No. 84/11 dated of October 27, 2012.

The NHDP is a strategic and operational tool used to implement the guidelines set out in the Long Term Development Strategy, known as “Angola 2025”, and in the National Health Policy. This plan covers all health areas and consists of nine programs, 16 strategies, and 20 projects.

Project 14 addresses the issue of Prevention, Early Diagnosis, and Treatment of malignant tumors. This project sets out the objectives and goals to be achieved to reduce the negative impact of cancer on the population.

The National Oncology Center (CNO, acronym in Portuguese) is responsible for coordinating the activities related to cancer prevention and care in the country. In May 2014, the Presidential Decree No. 229/14 transformed the CNO into the Angolan Institute for Cancer Control (IACC, acronym in Portuguese). The bylaws of the Institute were approved establishing the institute as a center of excellence for cancer. One of the main responsibilities of the IACC is to ensure the implementation of national policies, programs, and plans for cancer prevention and treatment.

In order to achieve this goal, the IACC developed the proposal for the National Program of Cancer Prevention and Control for Angola to be considered and discussed by the Ministry of Health and other partners. This proposal covers six dimensions that comply with the WHO guidelines for cancer prevention and control: prevention, early diagnoses, diagnosis and treatment, palliative care and rehabilitation, education and research, and cancer epidemiological surveillance.

Current Status of Cancer in Angola

According to the WHO STEPSwise approach to Surveillance the description of the current status of cancer in a particular region or country is the first step to be considered when developing a program to prevent and control cancer. The objective of this approach is to diagnose the status of the main components of a cancer control program and to plan the goals to be achieved and the strategies to improve the current situation (WHO, 2002).
Current Status of the Cancer Control Program in Angola

Angola still does not have a National Program of Cancer Prevention and Control. In 2007, the IACC, formerly CNO, drafted a proposal for the 2007-2013 Cancer National Policy. The proposal had 14 macro-objectives covering prevention, early detection, treatment, rehabilitation, and palliative care. However, this proposal was never approved.

In 2010, the Angolan National Health Policy was approved. This document does not include any specific descriptions related to the implementation of the cancer prevention and control program. Because there is not a control program, the CNO, as the only institution that specializes in oncology in the country and the advisory body for the Ministry of Health on issues related to cancer, coordinated all cancer prevention and control initiatives in the country.

Cancer prevention and control in Angola has had an official reference plan since the approval of the NHDP in 2012. The 14th project of the NHDP covers the topic of cancer prevention and control.

As mentioned above, in 2014, the Presidential Decree No. 229/14 dated of September 2 transformed the CNO into the IACC. According to this decree, the IACC is a public health facility and a national center of excellence integrated into the National Health Service to provide health care related to prevention, early diagnosis, and specialized and complex treatment of patients with cancer.

The IACC has the following responsibilities:

1. To provide medical care and medications for cancer patients on a permanent basis;
2. To ensure the implementation of national policies, programs, and plans of cancer prevention and treatment;
3. To develop standards of clinical, laboratory, biomedical research, educational, and occupational practice with regard to cancer prevention and treatment;
4. To ensure the rehabilitation of both inpatients and outpatients, as well as the provision of social services;
5. To set out and coordinate the activities related to training, information, education, communication, counseling, treatment, and follow-up in terms of cancer prevention;
6. To promote scientific research in the area of preventive and curative medicine, within the following fields: Clinical Oncology, General Surgical Oncology, Radiotherapy, Anatomic Pathology, etc.;
7. To promote, education, training, and technical and professional upgrading of health professionals, and to encourage the establishment of stable social and emotional relations between the personal or family needs of patients and cases of disease;
8. To develop standards of clinical, laboratory, biomedical research, educational, and occupational practice with regard to cancer prevention and treatment;
9. To develop and ensure the implementation of the Cancer Prevention and Control Program. Because there is not a control program, the CNO, as the only institution that specializes in oncology in the country and the advisory body for the Ministry of Health on issues related to cancer, coordinated all cancer prevention and control initiatives in the country.

Nevertheless, it is necessary to develop and approve a National Policy for Cancer Prevention and Control in order to achieve the objectives and goals set out in project 14 of the NHDP, which is the main reason for developing the National Program of Cancer Prevention and Control for Angola.

Extent of Cancer in Angola

The actual number of cancer cases has not been determined in Angola. The Population-Based Cancer Registry has not been implemented in the country so far. Because this tool is not available, the number of cancer cases in the country has been based on estimates from the International Agency for Research on Cancer (IARC). According to these estimates, cancer incidence and mortality in 2012 in Angola reached 10,305 new cases and 7,213 deaths, respectively (IARC, 2013). However, data from the Hospital-based Cancer Registry of the IACC (the only institution in the country specializing in cancer treatment) indicate that from 2007 to 2013 there were 6,920 new cases, with an annual average of 989 cases.

The most frequent neoplasms in both genders were breast cancer (22%), cervical cancer (16%), head and neck cancer (9%), Kaposi sarcoma (9%), prostate cancer (8%), skin cancer (4%), stomach cancer (3%), bronchi and lung cancer (2%), and Wilms tumor (2%) (Table 1). Nevertheless, these data do not reflect the actual amount of cancer cases in Angola because they are limited to the number of hospital-based cases.

Many cancer patients may not seek health care for an array of different contextual reasons. In addition, even those who sought health care may not have received the correct diagnosis due to lack of qualified health professionals and diagnostic resources. Also, even those who received a diagnosis of cancer may not have been referred to the IACC.

Table 1. Distribution of the 10 most frequent types of cancer at the National Oncology Center from 2007 to 2013.

<table>
<thead>
<tr>
<th>Tumor site</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>Subtotal</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>189</td>
<td>164</td>
<td>212</td>
<td>210</td>
<td>196</td>
<td>206</td>
<td>114</td>
<td>1,081</td>
<td>23%</td>
</tr>
<tr>
<td>Cervix</td>
<td>145</td>
<td>140</td>
<td>190</td>
<td>119</td>
<td>164</td>
<td>114</td>
<td>120</td>
<td>1,112</td>
<td>24%</td>
</tr>
<tr>
<td>Head and neck</td>
<td>96</td>
<td>124</td>
<td>146</td>
<td>124</td>
<td>87</td>
<td>71</td>
<td>71</td>
<td>636</td>
<td>9%</td>
</tr>
<tr>
<td>Esophagus</td>
<td>41</td>
<td>40</td>
<td>74</td>
<td>71</td>
<td>94</td>
<td>62</td>
<td>81</td>
<td>571</td>
<td>9%</td>
</tr>
<tr>
<td>Lung and pleura</td>
<td>55</td>
<td>62</td>
<td>100</td>
<td>100</td>
<td>63</td>
<td>66</td>
<td>68</td>
<td>411</td>
<td>6%</td>
</tr>
<tr>
<td>Prostate</td>
<td>54</td>
<td>57</td>
<td>55</td>
<td>49</td>
<td>69</td>
<td>67</td>
<td>70</td>
<td>374</td>
<td>8%</td>
</tr>
<tr>
<td>Stomach</td>
<td>45</td>
<td>42</td>
<td>58</td>
<td>58</td>
<td>54</td>
<td>34</td>
<td>34</td>
<td>218</td>
<td>4%</td>
</tr>
<tr>
<td>Skin</td>
<td>24</td>
<td>21</td>
<td>31</td>
<td>25</td>
<td>35</td>
<td>22</td>
<td>42</td>
<td>240</td>
<td>3%</td>
</tr>
<tr>
<td>Lung of emphysema</td>
<td>15</td>
<td>27</td>
<td>11</td>
<td>11</td>
<td>12</td>
<td>11</td>
<td>11</td>
<td>71</td>
<td>1%</td>
</tr>
<tr>
<td>Melanoma</td>
<td>8</td>
<td>10</td>
<td>20</td>
<td>22</td>
<td>20</td>
<td>23</td>
<td>20</td>
<td>83</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>204</td>
<td>286</td>
<td>225</td>
<td>200</td>
<td>160</td>
<td>162</td>
<td>162</td>
<td>1,186</td>
<td>21%</td>
</tr>
<tr>
<td>Total</td>
<td>813</td>
<td>962</td>
<td>916</td>
<td>864</td>
<td>700</td>
<td>800</td>
<td>1,024</td>
<td>8,500</td>
<td>18%</td>
</tr>
</tbody>
</table>

Source: Statistical Division of the Angolan Institute for Cancer Control.

Prevention

Cancer prevention is a public health measure aimed at preventing a specific disease. There is general prevention and specific prevention (WHO, 2002, Boyle, 2008; WHO 2, 2010).
On one hand, general prevention is based on health promotion and detection of risk factors associated with the development of diseases, thus reducing the population’s exposure. On the other hand, specific protection consists of vaccination against a particular biological agent (Boyle, 1991).

In Angola, cancer prevention is characterized by the population’s low awareness of risk factors and consistent public policies to reduce the population’s exposure to these factors. However, there are laudable initiatives, such as education programs to reduce the habit of smoking and alcohol consumption, in addition to the promotion of good habits, such as healthy diet and physical activity (Boyle, 2008).

As for specific protection, it is worth noting that the vaccine against Hepatitis B and C has been included in the immunization schedule for infants in 2006. Some advances have been made regarding the HPV vaccine. In November 2011, the Cervarix® vaccine (GlaxoSmithKline Biologicals SA) was introduced and the first 1,500 doses were donated to a hospital. Each dose cost 29 USD. The implementation of the HPV vaccine is planned for 2015.

Early Detection

Early detection consists of two approaches: screening and early diagnosis.

Screening

It is aimed at detecting precancerous lesions and treat them, thus preventing these lesions from developing into invasive lesions and, as a consequence, reducing cancer incidence and mortality (WHO, 2002; Boyle, 2008; WHO 3, 2010). Currently, this approach is not part of any organized programs in Angola. There are only encouraging initiatives related to breast and cervical cancer.

In terms of cervical cancer, these initiatives have been put in place by the IACC at three hospitals (Maternidade Lucrécia Pain, Maternidade Ngangula, Hospital do Huambo) and some private clinics. Nevertheless, there is still very low coverage. For instance, about 2,300 cervical smear tests were performed at the IACC in 2013. This number is much lower than the recommended considering the size of the population at risk.

As for breast cancer screening, it has been conducted at the IACC. The institute is equipped with five mammography devices; three of them are mobile. Cervical cancer screening test was introduced and the first 1,500 doses were donated to a hospital. Each dose cost 29 USD. The implementation of the HPV vaccine is planned for 2015.

Early Diagnosis

It is focused on educating the population so that people are able to recognize the clinical manifestations of the disease and seek health care when the signs and symptoms are detected. The main objective of this approach is to establish the diagnosis at an initial stage and provide appropriate treatment in order to increase the chance of cure or overall patient survival (WHO, 2002; WHO 3, 2010).

As for this approach, the IACC, in a partnership with the Angolan League of Combat Cancer, has conducted various educational activities through mass media campaigns, lectures, interviews, rallies against cancer, theater, etc. These activities should be encouraged to reach a larger number of people.

Diagnosis and Treatment

Appropriate cancer diagnosis and treatment are key factors to control the disease. They are associated with increased chance of cure and overall survival (WHO, 2010; WHO 4, 2010).

Because of the shortage of diagnostic resources, adequate infrastructure, qualified professionals, in addition to the low educational level of the population and cultural factors, about 80% of cancer cases in developing countries are detected at advanced stages, when the only possible treatment consists of palliative care (Pakin, 2002; WHO, 2008).

Considering the Angolan context, the country has limited infrastructure, poor diagnostic, technological, and human resources, and only one cancer center (the IACC) to meet the demands of its whole population.

The main cancer treatment approaches consist of surgery, radiotherapy, chemotherapy, and hormone therapy. Surgery and hormone therapy have been provided at different health facilities, whereas radiotherapy is available only at the IACC and Clínica Girassol. The IACC has a linear accelerator that is currently being used and other two accelerators are being installed. Clínica Girassol has two radiotterapy devices, however their availability is limited. Chemotherapy is provided at the IACC and Clínica Girassol.

In terms of diagnosis, different public and private hospitals offer imaging studies and pathology tests. However, they do not meet the needs of the country. For instance, the IACC has one CT scanner, one MRI scanner, five mammography devices (three of them are mobile), five ultrasound scanners, and one X-ray machine.

Palliative Care

Palliative care aims to treat cancer patients’ pain and provide psychological and spiritual support to patients and their families to ensure a dignified death (WHO, 2002; WHO 5, 2010).

Angola has a health policy on medications for chronic diseases. This policy ensures that opiates are provided free of charge for patients with chronic diseases to relieve their pain. Nevertheless, few patients are able to receive morphine. The IACC provides morphine for inpatients. However, when the patients are discharged they still need to continue being treated with this drug. And this does not happen due to lack of oral morphine. Therefore, patients often go to the Emergency Department of hospitals for treatment. In addition to lack of availability, there is also a small number of specialists in palliative care.

Education and Research

Research is an essential part of a cancer control program. Currently, Angola does not have any training centers for cancer professionals or research centers to conduct epidemiological and clinical studies.
Epidemiological Surveillance

The extent of cancer has not been determined in Angola because the country has not implemented the population-based cancer registry. As mentioned above, the current data on Angola are related to the IARC and IACC, the only center in the country that specializes in the treatment of neoplastic diseases.

Proposal for the National Program of Cancer Prevention and Control for Angola

The implementation of the National Program of Cancer Prevention and Control for Angola was prompted by the need to intensify and coordinate the actions against cancer in the country and reduce the negative impact of this disease on the population. The main objective of the National Program of Cancer Prevention and Control for Angola is to reduce cancer incidence and mortality, improving the quality of life of patients with neoplasms through the systematic implementation of evidence-based interventions for prevention, early detection, diagnosis and treatment, and palliative care.

Structure of the Proposal of the National Program of Cancer Prevention and Control for Angola

The National Program of Cancer Prevention and Control (NPCPC) will be implemented by a coordinator and a National Cancer Council serving as an advisory board. The NPCPC must have a physical facility, receive financial resources, have its own bylaws, and it will be composed of six committees:

- Prevention Committee;
- Early Detection Committee;
- Diagnosis and Treatment Committee;
- Palliative Care Committee;
- Education and Research Committee;
- Cancer Epidemiological Surveillance Committee.

Each committee will have a coordinator and will include a board of experts in various fields of knowledge in order to provide a holistic approach to the issues. The committees will be allowed to invite other experts to discuss specific topics on a temporary basis. The committees will be responsible for preparing and submitting the national recommendations related to their areas. These recommendations must be based on solid and cost-effective scientific evidence; they must be presented at a round table meeting with national and international experts and health managers under the coordination of the NPCPC Coordinator. When no solid scientific evidence is available, the committee may recommend research projects such as surveys, randomized trials, systematic studies, and cost-effectiveness studies. These committees will also be responsible for drafting budget proposals.

NPCPC Vision and Mission

Vision

Being the reference program in cancer prevention, early detection, treatment, rehabilitation, education and research within the 2012-2025 National Health Development Plan.
The following assumptions should be considered before implementing a screening program:

1. Is the disease a public health problem considering its extent and incidence?
2. Is there a technique allowing the detection of the disease at pre-invasive or malignant stages?
3. Are there resources available to screen at least 70% of the population at risk?
4. Are there diagnostic resources to confirm at least 70% of cases with suspicious results?
5. Are there resources to treat at least 70% of patients with confirmed diagnosis?
6. Are there randomized studies showing the impact on the reduced mortality from the disease?

After considering the assumptions mentioned above, the screenable cancers are breast cancer, cervical cancer, colorectal cancer, lung cancer (in the United States), and oral cavity cancer (in India). In African countries, because of the shortage of human and financial resources, screenable neoplasms are cervical and breast cancers.

Cervical cancer screening - Vaginal cytology, also known as pap test, is the most commonly used test to screen cervical cancer. The countries that implemented this technique, covering 80% of the risk population, reduced cervical cancer incidence and mortality by 75% (Willoughby, 2006). However, because this is a high-cost test for low-income countries, other cost-effective techniques, such as VIA (Visual Inspection with Acetic Acid) and VILA (Visual Inspection with Lugol Acetic), were also developed. A study conducted in India showed that women undergoing screening using VIA had a 30% reduction in their mortality rate when compared with women who were not screened (Sankaranarayanan, 2001; IARC, 2005; WHO 3, 2010).

The WHO recommends this technique for developing countries.

VIA and VILA techniques are simple methods and can be performed by trained nurses. Considering the Angolan context, the best strategy would be to implement both techniques: the pap test in urban areas and VIA in rural areas. The country has experience with both the pap test and VIA.

After establishing the diagnosis, a multidisciplinary treatment is required. A large number of skilled professionals is required to provide this type of treatment. Unfortunately, the amount of specialized human resources and equipment does not meet the demand in our country. That is, the only center in the country that specializes in cancer treatment and diagnosis has reduced staff and equipment (Table 2 and 3).

### Table 2. List of equipment available for diagnosis at the IACC

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory of anatomic pathology</td>
<td>1</td>
</tr>
<tr>
<td>Gastroscopy</td>
<td>1</td>
</tr>
<tr>
<td>Histology</td>
<td>1</td>
</tr>
<tr>
<td>X-Ray machine</td>
<td>2</td>
</tr>
<tr>
<td>Ultrasound scanner</td>
<td>2</td>
</tr>
<tr>
<td>Computer tomography scanner</td>
<td>2</td>
</tr>
<tr>
<td>Magnetic resonance device</td>
<td>1</td>
</tr>
<tr>
<td>Pathology device</td>
<td>1</td>
</tr>
<tr>
<td>Mobile devices</td>
<td>2</td>
</tr>
<tr>
<td>Clinical laboratory</td>
<td>1</td>
</tr>
</tbody>
</table>

### Table 3. List of experts working at the IACC

<table>
<thead>
<tr>
<th>Experts</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaesthesia physician</td>
<td>2</td>
</tr>
</tbody>
</table>
Amount

- Clinical oncologists: 10
- Hematologists: 7
- Paediatricians: 3
- Psychiatrists: 1
- Surgeons: 4
- Medical imaging specialists: 2
- Psychologists: 4
- Radiation therapists: 1

Technical Staff

- Anesthesiologists: 2
- Radiological technicians: 4
- Imaging technologists: 1
- Pathologists: 1
- Nurses: 20

### Treatment

Cancer treatment consists of several different types of interventions, including psychosocial support, surgery, radiotherapy, chemotherapy, and hormone therapy, with the purpose of curing the disease or prolonging life (for years), and improving the patients’ quality of life.

Currently, complete cancer treatment is only offered at the IACC. Cancer experts from different areas and trained abroad (Brazil, Portugal, Spain, Cuba) provide treatment based on studies published in the literature and adapted to the Angolan context.

Other hospitals only provide surgical treatment, and Clinical Grassol offers chemotherapy. Patients are referred to the IACC for chemotherapy and radiotherapy. Essential chemotherapy agents and supportive drugs for cancer patients are available at the IACC. The institute also has one fully operational radiotherapy device and two devices to be installed. A brachytherapy equipment is also being installed.

### Planning Diagnostic and Treatment Services

In spite of the development achieved in terms of scientific research, improvement of prevention measures, diagnosis and treatment techniques, there is an increasing number of new cancer cases, and cancer mortality has not been controlled yet (Boyle, 2006). The worst scenario is expected for developing countries because of the shortage of human and financial resources, poor infrastructure, and absence of cancer control policies. Approximately one third of cancer cases can be cured if detected at an initial stage, such as breast, cervical, and oral cavity cancers. Other types of cancer are very likely to be cured even when detected at an advanced stage, such as metastatic seminoma, acute leukemia, and childhood lymphoma. Therefore, when detected, these cancers can be treated efficiently even in low-income countries (Boyle, 2008).

Such treatment requires a rational planning of resources, combining diagnosis and treatment with early detection strategies and health policies that promote and facilitate the access of all citizens in a timely manner. This strategy avoids diagnosis at an advanced stage, when treatment is more expensive and ineffective, which leads to the use of palliative care because of the possibility of treating a larger number of patients for the same cost.

The main objectives of cancer diagnosis and treatment are to cure the disease, prolong life, improve the quality of life after a cancer diagnosis that has been appropriately confirmed using the procedures available, and make treatment more effective when associated with early detection programs based on standardized care (WHO, 2002; Boyle, 2006; WHO 4, 2010).

Greater effectiveness is achieved when patients who are more likely to be cured are given priority. The remaining resources should be used to treat patients with treatable but incurable cancers, considering aspects related to cost-effectiveness, purchasing power, ethical and social aspects, therefore promoting equal access for all patients.

### Palliative Care

Millions of cancer patients require palliative care worldwide. Based on proper planning, most patients with advanced cancer may have their suffering relieved and their quality of life significantly improved (WHO 5, 2010).

Palliative care promotes the relief of pain and other symptoms, integrates the patient’s psychological and spiritual aspects, promotes life in a more active manner as much as possible, and supports the patient’s family during the illness. Therefore, palliative care should be started early. Palliative care should be integrated into the existing health system, including proper training of health professionals in this type of care.

### Education and Research

The training of professionals to deal with all aspects of cancer prevention and control is critical. Unfortunately, in the African continent and Angola, in particular, high quality training is scarcely available. There is lack of qualified cancer professionals at all levels. Thus, it is necessary to implement a medical specialist training program (for clinical oncologists, radiotherapists, cancer surgeons, pathologists, radiologists, hematologists, pediatricians, radiology technicians, cytopathologists, VIA technicians, cancer nurses, public health specialists, epidemiologists, and statisticians). According to this point of view, it is of utmost importance to implement a training center at the IACC in cooperation with schools of medicine, the Instituto Médico Profissional de Saúde, and other international centers.

In terms of research, it should be noted that this is a process based on the production of new knowledge and the confirmation or refusal of existing knowledge. In this regard, Angola lacks a qualified research center for conducting epidemiological research, clinical research, and collaboration with other international research centers of excellence. Therefore, the implementation of such a research center is essential so that research groups can fulfill this deficiency.

### Cancer Epidemiological Surveillance

Cancer epidemiological surveillance is a tool that can provide cancer epidemiological data for the Population-Based Cancer Registries (PBCR). The PBCR is an information system that collects, analyzes, interprets, and disseminates information about cancer in a systematic manner, considering predetermined populations and time periods, with the purpose of measuring the extent of cancer and its future trend. This system provides the basis for the investigation of risk factors and helps plan preventive and care measures for cancer control, monitoring, and evaluation. (Jensen et al., 1991; WHO, 2002) (Shanmugaratnam, 1991).
In addition to the PBCR, there is the Hospital-Based Cancer Registries (HBCR), which collects cancer data from a particular hospital or cancer facility focused on clinical care and hospital administration, serving as the main source of information for the PBCR at the same time (Greenwald, 1986; Shrimpgrammat, 1991).

Despite its usefulness, many developing countries lack or have low coverage of PBCR, which is an important limitation when it comes to determining the extent of this disease. According to the IARC, only 11% of the African population, 8% of the Asian population, and 21% of the Latin American population have cancer registry coverage (Parkin, 2006). The data on cancer incidence and mortality available in the GLOBOCAN are estimates. Within an optimal framework, the data to support the rational design of a National Policy of Cancer Control must be based on confirmed data provided by the PBCR (Estefan et al, 2013).

Angola is an African country where the extent of cancer is unknown (WHO/ICO, 2010). The Cancer Registry that was initiated in 1987, culminating with the publication of a series of four years (1987-1990) in 1991 was interrupted. (Parkin et al, 2003) (Teixeira, 1991). Developing a National Policy of Cancer Control that is able to determine the extent of cancer and its epidemiologic profile is essential to achieve rational planning, monitoring, and evaluation. Thus, the implementation of a PBCR is required.

This subprogram will be coordinated by members of the Education Committee who will be responsible for drafting and suggesting the syllabus of the courses to be implemented. The members of the committee will be allowed to invite national or international experts in specific issues, as well as to hold scientific events and conduct technical visits to other international centers for updating and training purposes. It is recommended that the subprogram use its own financial resources to implement its activities.

Conclusions

The objective of the current proposal of the National Program of Cancer Prevention and Control for Angola is to implement measures aimed at reducing the negative impact of cancer on the Angolan population. This proposal is based on the WHO recommendations concerning cancer prevention and control adapted to the Angolan context. The document was drafted by the technical group of the IACC under the supervision of the General Director, Dr. Fernando Miguel.

The project was divided into six major dimensions of cancer prevention and control: Prevention, Early Detection, Diagnosis and Treatment, Palliative Care, Education and Research, and Cancer Epidemiological Surveillance. Each dimension of the program will be coordinated by a committee named after each dimension, which will be responsible for preparing the recommendations, supervision, and evaluation of the planned activities. Each dimension of cancer prevention and control is presented as a NPCPC subprogram with its activities, people in charge, expected results, and evaluation method. Goals have not been established during this first phase because baseline data are missing for most situations. All those involved in the implementation of this project who have access to this document are expected to give suggestions and recommendations to improve the document.
Burkina Faso has a population, estimated in 2014, of 17,880,986 inhabitants. An important proportion (48%) of inhabitants is aged less than 15 years.

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>17,880,986</td>
<td>17,880,986</td>
<td></td>
</tr>
</tbody>
</table>

Burden of Cancer

There is no operational cancer registry in Burkina Faso. A cancer registry in the city of Ouagadougou was set up within the pathology service of the “Centre Hospitalier Universitaire Yalgado Ouédraogo” with the help of the International Agency for Research on Cancer (Lyon, France). Unfortunately, this registry is currently not running due to lack of funding.

According to the national annual statistical report, 3,886 cancer cases were notified by health facilities in 2014.

<table>
<thead>
<tr>
<th>Items</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of cancer cases</td>
<td>3,886</td>
<td>3,886</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>835</td>
<td>675</td>
</tr>
</tbody>
</table>

Resources in Oncology

There is no specialised cancer centre in Burkina Faso. Cancers remain treated in university hospital centres. The following four centres are the largest hospitals currently treating cancer:

- Centre Hospitalier Universitaire Yalgado OUEDRAOGO Ouagadougou
- Centre Hospitalier Universitaire Soro SANOU Bobo Dioulasso
- Centre Hospitalier Universitaire Pediatrique Charles de Gaulles Ouagadougou
- Centre Hospitalier National Blaise COMPAORE Ouagadougou

One medical school is located in Ouagadougou, the “Ecole Superieure de Sciences de la Sante”, University of Ouagadougou.

Human Resources

Medical Oncology resources in Burkina Faso are limited.

<table>
<thead>
<tr>
<th>Items</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>17,880,986</td>
<td>17,880,986</td>
</tr>
<tr>
<td>Number of pathologists</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of pathologists per million population</td>
<td>0.44</td>
<td>0.44</td>
</tr>
<tr>
<td>Number of pathologists in training</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of oncologists</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of oncologists per million population</td>
<td>0.16</td>
<td>0.16</td>
</tr>
<tr>
<td>Number of histotechnologists</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of histotechnologists per million population</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Number of cytotechnologists</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of cytotechnologists in training</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Molecular genetics laboratories per million</td>
<td>0.16</td>
<td>0.16</td>
</tr>
<tr>
<td>Are IHC services available?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Are chemotherapy available?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Are radiation therapy available?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Number of most hospitals (100 per year)</td>
<td>501-1000</td>
<td>501-1000</td>
</tr>
<tr>
<td>Average turnover for small biopsies</td>
<td>2.45</td>
<td>2.45</td>
</tr>
</tbody>
</table>
While treatments for breast cancer are almost identical between different health facilities, cancer treatment is in general highly heterogeneous across the country. The absence of a cancer centre results in patient’s treatment being organised in different services and in private clinics. A service of medical oncology is linked with the department of general surgery.

In term of primary prevention, smoking in public places is officially forbidden. Several problems can be identified:

Problems for cancer diagnostics and prevention

Clinically
With the absence of organised screening, early detection is done on an individual basis. Only cervical cancer could benefit from NGO’s campaigns. Vaccination against HPV exists in some dispensaries (Cervarix). While smoking in public places is forbidden, the law is not enforced and therefore non-operational.

Pathology
Results from pathological examination are reported with sometimes long delays. Some results are incomplete or non-useable. There is an absence of immunohistochemistry with dosage of hormonal receptors, Her2 and CD. There is no immunological typing and no extemporaneous exams.

Medical imaging
Reports are sometimes hard or impossible to exploit. Scanners and MRI are available in the country but not always reachable by patients.

Problems for cancer treatment
An important problem is the absence of institutional multidisciplinary meetings.

Medical Treatment
More than 70% of patients receiving chemotherapy were initially diagnosed with advanced stage cancers. No national protocol exists to define chemotherapy plans to be applied throughout the country, and several anti-cancerous drugs are lacking in hospital and national pharmacies although some molecules can be available in private pharmacies. Mostly used molecules are: doxorubicin, cyclophosphamide, fluorouracil, docetaxel for breast cancer, cisplatin for cervical cancer and methotrexate for choriocarcinoma. All other molecules can only be obtained by purchasing them in private pharmacies. Conditions for elaboration of anti-cancerous drugs are inadequate with no centre for preparing them and no trained paramedical personnel to administer drugs, drugs are prepared for administration by external service providers.
Anti-cancerous and adjuvant drugs are expensive and not covered by health insurance. It results that all costs should be handled by the patients. Morphine treatments are rarely available.

Surgical Treatments

With a majority of advanced stage tumours, surgery is often limited to palliative surgery while more and more patients are diagnosed with operable cancers. Surgical skills are concentrated in Ouagadougou only. As mentioned earlier, a limitation of surgical treatment is the absence of extemporaneous exams. Material for surgery is often lacking or absent such as material for oncoplastic surgery and implantable ports.

Radiotherapy Treatment

As mentioned earlier, there is no radiotherapy machine in Burkina Faso.

Other Difficulties

Other difficulties are worth mentioning. There is major insufficient human resources in oncology, paediatric oncology, pathology, onco-hematology, onco-gynaecology, and trained paramedical personnel.

There is an absence of statistics in oncology with the cancer registry of Ouagadougou not operational anymore and no hospital statistics. Overall, no support for patients to cover treatment costs.

Perspectives

Some perspectives of improvements in oncology are ongoing in Burkina Faso. First, a strategic national plan to fight against cancer is in deployment phase. A cancer centre will be established in Ouagadougou. Universal health coverage will be developed and reduce the burden of cancer treatment costs to the patients.

Chapter 16c

Burundi

Burundi is a landlocked country in East Africa with a total area of 27,834 km². The country is divided into 19 provinces. According to the 2008 census Burundi has a total population estimated to 9,863,117 millions in 2010. There is a slight preponderance of women. The population is relatively young with 45.7 percent being below the age of 15 years and 19.3% aged between 15-24 years. This represents 65% of the population under 25 years and only about 2.5% being 65 years and above. The population growth rate is 3.28%. Most of this population (89.1%) lives in is rural areas and about 10.9% urban population. Life expectancy from birth is approximately 59 years.

Cancer Registration and Overview of Cancer

Burundi does not have national cancer registry and therefore the data for the incidence of cancers and cancer mortality in Burundi can only be estimated. A study conducted from 1984 to 2008 discovered 4,305 cancer cases (unpublished data). This survey showed that most frequent cancers in men are stomach (16.99%), soft tissue and Kaposi’s Sarcoma (12.09%), skin cancer (9.78%) and lymphoma (7.26%). The most frequent cancers in women are cervical cancer (15.35%), breast (12.78%), stomach (12.58%), skin (7.55%) and lymphoma (7.15%).

Others findings from the 7th Congress of Surgery organised by the Burundian Association of Surgery (ABUC) in October 2013, highlighted that stomach cancer is the most frequent form of cancer in men followed by lung and prostate. Cervical cancer, breast and ovary are the most common cancers in women. In children, retinoblastoma and nephroblastoma are the two most frequent solid tumours.

There is lack of data on HIV/AIDS related to cancers.
in that laboratory. Services are greatly affected by shortage of skilled staff. There are only 2 pathologists for the whole country. It is estimated that 12 pathologists are needed for the whole population of Burundi if one pathologist is to serve 250,000 people. The three technicians working in the laboratory are trained on the bench and qualified as histotechnologists.

Appropriate preservation of specimen is needed and includes prompt immersion in formalin. Sometimes this can present challenges especially in outlying areas where alternative media may be used which may distort results. Due to a limited number of pathologists and lack of equipment, quick-frozen section diagnosis is not available. Fine needle aspiration is not frequently performed in the teaching hospital and is not available in all hospitals.

There is no residency training in pathology in the country.

**Oncologists Available**

There is no medical/radiation oncologist or paediatrician, surgeons, gynaecology oncologist working in the country. There is no residency training in radiation oncology/clinical oncology in country.

**The National Cancer Control and Prevention Program**

The Ministry of Public Health and Aids Control formulated and adopted the National Cancer Control policy and programme and the Cancer Prevention and Control Strategy (2015-2020). The overall goal of the strategy is to reduce cancer morbidity and mortality through implementation of evidence-based, cost-effective prevention and control interventions and providing palliative care to improve quality of life of people living with cancer and their families by 2020. The Goal Areas are Programme Strengthening, Primary Prevention, Early Detection, Diagnosis and Treatment, Palliative Care/Rehabilitation and Surveillance and Research.

**Prevention and Early Detection**

Currently there is no screening programme for cervical cancer or breast cancer. However at the individual level, the practice of taking Pap smears, making mammography screening and PSA testing are recommended by clinicians for those people who can afford to pay.

The main risk factors contributing to the high incidence of cancer in Burundi, as with most African countries, include infectious agents and lifestyle-related factors such as tobacco use, harmful alcohol use, unhealthy diets and physical inactivity. Prevention becomes the most cost-effective intervention; therefore, this approach that has been adopted in Burundi. Many of the cancers are diagnosed at an advanced stage, due to limited resources. A focus on early detection is therefore warranted.

**Tobacco**

It is important to be noted that the Framework Convention for Tobacco Control has not yet been ratified in Burundi.
Alcohol Consumption

There is no national survey of alcohol consumption and the prevalence is unknown. Some measures have been taken to try to reduce the consumption of alcohol for example restricting the places and times alcohol is available and raising the minimum legal age at which alcohol is purchased.

Diet and Exercise

The prevalence rate of obesity is 2.9% (2008) in Burundi. The lifestyle in urban areas is changing. The message of losing weight and exercising to help reduce the risk of developing cancer is promoted through some media.

Infections

At national level, the prevalence of HBV is 4.6% and 8.1% for HCV (Ntagirabiri R et al., 2014). Infectious risk factors which promote cancer in Burundi include HPV, Hepatitis B and C, HIV, EBV, Helicobacter Pylori. Promotion of interventions such as hepatitis B vaccination is offered in large immunisation programme.

HPV vaccination was approved in 2014 and supported by the Global Alliance on Vaccines and Immunisation (GAVI); this requires sharing ability to vaccinate an adolescent population. In April 2016, the HPV vaccination demonstration project will be implemented in two district hospital: Rumonge and Ngozi have been selected for this project. Vaccination will be conducted in 10 year old girls using the school based strategy. National scale up vaccination will follow.

Cancer Screening Services

National cancer screening programs are not yet running in the country. Initiatives for individual screening are organised in different clinics/hospital for some conditions and cancers: these include cirrhosis surveillance in HBV and HBC chronic infection, pap smears for cervical cancer and mammography for breast cancer.

Awareness of the importance of breast self-examination still needs to be prioritised together with instruction on the technique of how to perform self-examination of the breasts.

Cervical Cancer

Visual Inspection with Acetic Acid (VIA) was initiated in health centres located in the capital city after training organised by a team of researchers from the Department of Obstetrics and Gynaecology, the pathology laboratory, University of Burundi and in collaboration with the Division of Non communicable disease of MOH under the logistics support from WHO office in Burundi.

PAP smear services are available at the pathology laboratory of the University teaching hospital but not available to the majority population in need for screening.

Palliative Care

Palliative care and rehabilitation are not well organised for cancer patients in Burundi.

Drugs

There is a lack of drug supply and there is no policy for managing their supply and distribution.

Education of Cancer Care Professionals (human resource development)

There is no existing training programme for different categories of cancer care professionals. This is a challenge which requires to be overcome for the success of the implementation of the cancer prevention and strategy adopted recently by MSPLS. It is essential to develop a multidisciplinary approach to cancer management.

The Cancer Community

There are a few numbers of local voluntary organisations that are involved in cancer efforts in Burundi.

References

Ministère de la Santé Publique et de la Lutte contre le SIDA. Politique nationale de lutte contre le cancer au Burundi, 2015a.
The Republic of Cameroon is a bilingual country (French and English) in the Central Africa region. Its surface area is 475,440 km² and its total population is 19,406,100 inhabitants, according to the 2010 census. The Ministry of Public Health is responsible for Cameroonian population’s health issues. This Ministry has developed several plans relating to the main public health issues of the country. One of them is the National Plan to Fight against Cancer. Founded in 2002, this plan is in charge of managing cancers across the country. It mainly aims at reducing cancer incidence, morbidity and mortality. To this end, prevention, diagnosis and treatment activities are carried out in some cities of the country.

Epidemiological Data

In Cameroon, an average of 14,000 new cancer cases is registered each year, with 25,000 prevalent cancers. When patients arrive in cancer centres, about 80% of them are diagnosed at an advanced stage of cancer. According to estimates by the Yaounde Cancer Registry, 8 to 10% of deaths are due to cancer.

Between 2004 and 2011 Yaounde Cancer Registry has registered 6,152 registered cancer cases, approximately one third in men and two thirds in women. Children represent 10.3% of cases (633 cases). Figure 1 shows the most common cancers.

### Table 1: Distribution of cancer cases at SOMGHY by age group in 2012

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;15</td>
<td>14</td>
<td>0.1</td>
</tr>
<tr>
<td>15-24</td>
<td>22</td>
<td>2.1</td>
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<tr>
<td>25-49</td>
<td>19</td>
<td>1.9</td>
</tr>
<tr>
<td>50-69</td>
<td>186</td>
<td>18.3</td>
</tr>
<tr>
<td>70-79</td>
<td>222</td>
<td>22.2</td>
</tr>
<tr>
<td>80+</td>
<td>214</td>
<td>21.4</td>
</tr>
<tr>
<td>Total</td>
<td>937</td>
<td>100</td>
</tr>
</tbody>
</table>
The main cancer therapies are surgery, chemotherapy and radiotherapy (Ndom, 2008). Targeted therapies are not yet implemented. These therapies are used in general hospitals in Yaounde and Douala. At this level there is a critical issue of supply of antimitotics and maintenance of radiotherapy equipments. Medical oncologists and radiotherapists are too few and are gathered in both the biggest cities of the country, Yaounde and Douala.

**Palliative Care**

There is no actual centre for palliative care. Considering the high number of examined patients who have advanced-stage cancer, most treatments are palliative. The main analgesics, especially morphine, are not used at a large scale. SOCHIMO is conducting a project about palliative care at home, but it struggles to start due to the lack of funding.

**Follow-up**

The large distances between care centres and places where patients live leads to a high number of lost to follow-up. Therefore follow-up care is problematic. Some district hospitals are not trained for the follow-up of cancer patients.

**Research**

Research in oncology is mostly carried out in general hospitals and in faculties of medicine during some thesis works. Research is rarely funded.

**Training of Human Resources**

For about three years, the Faculty of Medicine and Biomedical Sciences of the University of Yaounde has been training medical oncologists, radiotherapists, anatomical pathologists, radiologists and other specialists. The Republic of Cameroon is behind the times in terms of training of nurses and specialised technicians.

**Difficulties**

There are considerable challenges in providing adequate cancer care in the Republic of Cameroon as well as other developing countries (Price et al, 2011). Difficulties in management of cancers in the Republic of Cameroon are due to the very small grant awarded to the National Plan for Fight against Cancer by the Ministry of Public Health and international organisations. There is no social security in the Republic of Cameroon and cancer patients have to pay themselves their treatments. All antimitotics are imported. One cancer treatment sometimes costs five times as much as the patient’s annual income. The delayed arrival of patients to the hospital shows the insufficiency of awareness, as well as financial and logistics difficulties faced by these patients. The northern part of the country is very far from specialised hospital trainings that are concentrated in the central region of the Republic.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>61 - 70</td>
<td>108</td>
<td>11.5</td>
</tr>
<tr>
<td>(+70)</td>
<td>57</td>
<td>6.1</td>
</tr>
<tr>
<td>undefined</td>
<td>8</td>
<td>1.0</td>
</tr>
<tr>
<td>Total</td>
<td>937</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Distribution of cancer cases by gender in 2012

<table>
<thead>
<tr>
<th>N°</th>
<th>Gender</th>
<th>Number of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>606</td>
<td>64.7</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>331</td>
<td>35.2</td>
</tr>
<tr>
<td>Total</td>
<td>937</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Mass screening is sporadic and mostly focuses on breast, cervical and prostate cancers. Only two to three regions are concerned by this screening, due to lack of logistics and financial resources. A training course for cytologists and midwives took place in 2006 and 2007, in order to increase human resources within screening teams.

Cervical cancer screening in Cameroon is carried out with smear tests and by visual inspection with acetic acid (VIA) or lugol’s iodine (VILI). Regarding breast and prostate cancers, medical examination is the preferred screening method, supported by mammography, ultrasound scan techniques and PSA blood test, depending on the case.

**Vaccination Campaign**

Vaccination against viral hepatitis is part of the Expanded Program on Immunization (EPI) of Cameroon between 0 and five year old. HPV vaccination is not yet systematic, although a preliminary study on Gardasil involving 5,000 young girls has already been carried out in 2009.

**Awareness Campaigns**

Awareness campaigns are conducted in some communities or through media and usually target the fight against risk factors, especially smoking and environmental factors. NGOs, as for instance SOCHIMO (Solidarity Chemotherapy) play a major role in education and communication in spite of their lack of financial means.

**Diagnosis**

Cancers are mostly diagnosed in large hospitals, which have laboratories of anatomical pathology and more radiological equipment (standard x-ray, scanner and MRI). Diagnostic nuclear medicine is only practised at Yaounde General Hospital. The Pasteur Centre in Cameroon is the reference laboratory for the dosage of tumour markers and hormone receptors.

The main cancer therapies are surgery, chemotherapy and radiotherapy (Ndom, 2008). Targeted therapies are not yet implemented. These therapies are used in general hospitals in Yaounde and Douala. At this level there is a critical issue of supply of antimitotics and maintenance of radiotherapy equipments. Medical oncologists and radiotherapists are too few and are gathered in both the biggest cities of the country, Yaounde and Douala.

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Outlook

The fight against cancer in the Republic of Cameroon should extend to the most distant communities, more focusing on education and communication. This action will require more logistics, financial and human resources. An international grant like those awarded to plans for AIDS, tuberculosis and malaria would be of major importance to help solve cancer patients’ problems. The same applies for the opening of a cancer institute in Yaoundé. Training of human resources (doctors, nurses, technicians, etc.) is essential when we know that, according to WHO, “65% of cancers will come from developing countries in 2020 if nothing is done”.

Congo - Brazzaville

Judith Nsondé Malanda

The Republic of Congo, also known as Congo-Brazzaville, is located in Central Africa. There were 4,755,000 inhabitants as of 2015. The population is very young as more than 50% of the population is aged below 25 years of age.

Cancer Burden

The Brazzaville population-based cancer registry (PRCR) collects data on cancer cases occurring in the Brazzaville population. It was created in 1996 with the support of the International Agency for Research on Cancer and has been collecting reliable data since 1998 (Nsondé Malanda et al, 2013). The registry gathers information on new cancer cases from four hospitals and four private clinics. It covers a population of around 1,700,000, i.e. around a third of the total country population (Figure 1). The population structure is similar to the rest of the country, with a very young population.
The State of Oncology in Africa – 2015

Figure 1: Population pyramid of the population covered by the Brazzaville cancer registry, 2014.

In women, the most frequent cancers are breast, cervix, liver, ovaries and hematopoietic system (Table 2). In children, cancers of the kidney, retinoblastoma, bones, liver, blood and soft tissues are the most frequent.

Table 1: Frequency of cancer sites by age in men, from the Brazzaville cancer registry.

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<th>Site</th>
<th>ICD-0</th>
<th>Age Group</th>
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Table 2: Frequency of cancer sites by age in women, from the Brazzaville cancer registry.

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The most common cancers in men are prostate, liver, stomach, skin and lung (Table 1).
In terms of age-standardised incidence rates, a recent study reported 36 cases per 100,000 person-years in men for liver cancer, and 4 per 100,000 in women. Rates of breast and cervical cancers were 14 per 100,000 and 12 per 100,000, respectively (Nsondé Malanda et al, 2013).

### Resources in Oncology

#### Cancer Centres

There are cancer centres in Brazzaville (the capital city) and Pointe Noire (the economical capital). Those hospitals employ medical oncologists. There is a radiotherapy service in the University Hospital of Brazzaville. The radiotherapy unit uses a cobalt machine, and this is the only radiation therapy equipment available in the whole country. There is no brachytherapy unit in Congo. Few secondary centres provide services in oncology and surgery.

#### Human Resources

Cancer health professionals in the Republic of Congo are scarce. In Brazzaville, there is one radiation therapist, one general surgeon with a diploma of Medical Oncology, three onco-haematologists and eight medical oncologists. In Pointe Noire, there are only two medical oncologists. There are no other oncologists in the rest of the country.

The number of patients who need radiation therapy is much higher than the only radiation therapist can handle, which causes delays. In addition, surgical care of cancer cases is often postponed as there is no surgical oncologist.

Unfortunately, the lack of personnel is expected to worsen in the near future as several medical oncologists are close to retirement.

#### Pathological Laboratories

There are two pathological anatomy laboratories in the Republic of Congo, in Brazzaville and Pointe Noire. The laboratories are limited to morphological studies in 95% of cases. Immunohistochemistry and molecular studies are rarely done. Because of the lack of human resources, it takes between three and 12 months to get results of a sample examination. This leads to more delays in diagnosis and treatment of patients. There is no specific molecular oncology laboratory.

#### Oncology Policies

A strategic plan to fight against cancer has been adopted in May 2013, yet has not been enforced to date. So far, anti-cancer policies are often the result of isolated experiments.

A tobacco control law has been voted in 2012 at the National Assembly of the Republic of Congo. This law forbids:

- the advertisement of tobacco products on TV, radio and other media;
- tobacco use in public places and public transports;
- sell of tobacco products to minors and pregnant women;
- free distribution of tobacco products.

In addition, prevention messages must be written on tobacco products.

Concerning cervical cancer, two pilot areas received HPV vaccination in 2013-2014. Moreover, there were some prevention campaigns based on visual inspection methods, but they were concentrated in the city of Brazzaville.

Vaccination against hepatitis B has recently been added to the vaccination programme of infants, which should help reducing the incidence of liver cancer in the future.

Finally, breast cancer awareness campaigns have been organised by local associations fighting against cancer. However, no national initiative exists.

#### Perspectives

Medical Oncology in the Republic of Congo is still an orphan. Structures and human resources are largely insufficient for a nearly 5,000,000 inhabi- tant’s country. There is only one old Cobalt radiotherapy machine and one radiation therapist and no brachytherapy. The lack of personnel leads to delayed diagnosis and treatment of patients, who mostly present at a late stage of the disease. Because of these delays, combined with the late stage at presentation, many patient die before any investigation is conducted, or die before receiving any treatment.

The absence of immunohistochemistry and molecular studies have implications on the availability of targeted therapies. Finally, the unavailability of anti-cancer drugs, remains a problem which partly explains poor adherence to treatment.

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**Reference**

Cancer in the developing world is characterized by far more advanced stages at diagnosis, fewer allocated resources for prevention and treatment, and higher incidence than in countries with more developed health systems. In Egypt, it is already and will become an important health problem not only in terms of rank order, but also in terms of incidence and mortality. The commonest sites were liver among men and breast among women. During the period 2013–2050, the population of Egypt is expected to increase to approximately 1.6 times the 2013 population size. Applying the current age-specific incidence rates to successive populations would lead to a progressive increase in the number of incident cases of cancer. The resources for cancer control in Egypt are directed almost exclusively to the community should be fostered, particularly for prevention of hepatitis B and C infection, and breast cancer screening. For people with chronic diseases often have a long illness trajectory and, during that time, may have different palliative care needs. As their disease progresses, they may experience a complex range of social and emotional needs including isolation, deceased independence and burden on family members. Most people with chronic illnesses other than cancer often reach the terminal phase of their life without having been offered effective palliative care (Fitzsimons et al, 2007). Palliative care is the active holistic care of patients with advanced, progressive illness. Management of pain and other symptoms and prevention of psychological, social and spiritual support is paramount. The goal of palliative care is achievement of the best quality of life for patients and their families. Many aspects of palliative care are also applicable earlier in the course of the illness in conjunction with other treatments (World Health Organisation, 2008). Palliative care goes beyond the traditional medical model to focus on psychosocial issues, spiritual matters, medical decision-making, and on the relief of suffering in all its dimensions throughout a person’s life (Smith et al, 2012). Because of its focus on the whole person, more experts are advocating that a palliative approach to care should and could be integrated into care for all people with chronic, life-limiting conditions (including cancer). The rationale for integrating palliative care into chronic disease management is the recognition that people with chronic diseases often have a long illness trajectory and, during that time, may have different palliative care needs. As their disease progresses, they may experience a complex range of social and emotional needs including isolation, deceased independence and burden on family members. Most people with chronic illnesses other than cancer often reach the terminal phase of their life without having been offered effective palliative care (Fitzsimons et al, 2007).

Introduction
Cancer is a global and international problem. It is the second leading cause of death worldwide after heart and vascular disease. It accounted for 8.2 million deaths in the year 2012. Among the most frequent causes of death are liver, stomach, colorectal and breast cancers. Unfortunately, the trajectory of the cancer experience and may be the sole focus of care for those patients with advanced incurable disease. As the incidence of cancer increases worldwide and the burden of cancer rises, especially in low and middle resource countries, the need for palliative care is greater than ever before and this care is most effectively provided by a multidisciplinary team. So, recognizing palliative care as a new subspecialty for nurses, and expansion of palliative care services to a larger number of patients and illnesses throughout the country, considering home-based palliative care service is urgently and badly needed, strengthening health care systems; focusing on patient centred care, education and training to all levels of health care professionals, and effective cancer prevention programmes customized to the community should be fostered, particularly for prevention of hepatitis B and C infections, and breast cancer awareness, reducing cultural barriers, and detecting cancer as early as possible.

Annual cancer cases are expected to rise from 14 million in 2012 to 22 million within the next two decades (Ferlay et al, 2012). Cancer is an increasing problem in Egypt. The commonest sites were liver (23.8%), breast (15.4%), and bladder (6.9%) (Both sexes): liver (33.6%) and bladder (10.7%) among men, and breast (32.0%) and liver (13.5%) among women. By 2050, a 3-fold increase in incident cancer relative to 2013 was estimated, these results based upon results of National Cancer Registry Program (NCRP) (Ibrahim et al, 2014). Egypt is expected to experience the highest increase in the coming two decades. Cancer is already an important health problem and will become increasingly important not only in terms of rank order, as infections are better controlled, but also in terms of incidence and mortality, which will both increase as populations continue to grow and age, and as risk factors for cancer associated with greater affluence continue to increase. At present, resources for cancer control in Egypt are not only inadequate but directed almost exclusively to treatment. This strategy, although successful to a degree, is suboptimal because the impact of preventive measures on incidence is not taken full advantage of, while the lack of approaches to earlier diagnosis reduces the value of therapy. The curability of cancer is directly related to its stage at the time of diagnosis, and in the majority of cancer is generally diagnosed when at a relatively advanced stage. According to WHO, 40% of cancers could be avoided (prevention), 40% could be cured (if detected early) and the rest should be managed with palliation. Prevention therefore offers the greatest public health potential and the most cost-effective long-term approach for cancer control (World Health Organisation, 2009).

Diagnosis of cancer and its treatment can have a devastating impact on the quality of a patient’s life, as well as on the lives of families and other care givers. Patients face new fears, uncertainties and may have to undergo unplanned and debilitating treatments. Therefore, patients and their families need access to support from the time that cancer is first suspected, through all stages of treatment to recovery or, in some cases, to death and bereavement (Ellershaw et al, 2003). Patients with advanced cancer experience a range of complex problems that cannot always be dealt with effectively by generalist services. Therefore, they require a range of services to ensure that their physical, psychological, social and spiritual needs are met effectively and to enable them to live and die in the place of their choice. Thus, hospices and specialist palliative care services should be accessible and available (NHS CYMRU Wales, 2001).

Palliative care is the active holistic care of patients with advanced, progressive illness. Management of pain and other symptoms and provision of psychological, social and spiritual support is paramount. The goal of palliative care is achievement of the best quality of life for patients and their families. Many aspects of palliative care are also applicable earlier in the course of the illness in conjunction with other treatments (World Health Organisation, 2002). Palliative care goes beyond the traditional medical model to focus on psychosocial issues, spiritual matters, medical decision-making, and on the relief of suffering in all its dimensions throughout a person’s life (Smith et al, 2012). Because of its focus on the whole person, more experts are advocating that a palliative approach to care could and should be integrated into care for all people with chronic, life-limiting conditions (including cancer). The rationale for integrating palliative care into chronic disease management is the recognition that people with chronic diseases often have a long illness trajectory and, during that time, may have different palliative care needs. As their disease progresses, they may experience a complex range of social and emotional needs including isolation, deceased independence and burden on family members. Most people with chronic illnesses other than cancer often reach the terminal phase of their life without having been offered effective palliative care (Fitzsimons et al, 2007).

Egypt: Background Information
Egypt is located in the north-eastern corner of Africa. Rectangular in shape, it covers an area of 386,000 square miles. To the West lie the Western Desert and Libya, and to the East is bordered by a desert plateau, Red Sea, Sinai and Israel. The Sudan is on Egypt’s southern border and to the North lies the Mediterranean. Egypt can be divided into: The Eastern Desert, The Western Desert, and The Nile Valley. 90% of Egypt is desert; the majority lies the Mediterranean. Egypt can be divided into: The Eastern Desert, The Western Desert, and The Nile Valley.
The Egyptian health system: The health care system in Egypt is quite complex with a large number of public entities involved in the management, financing and provision of care. Egypt's wide network of public (several Ministries beside the military and police), NGO, faith-based charity organizations and private health facilities allow good geographic accessibility and coverage. The Ministry of Health and Population is responsible for overall health and population policy as well as the provision of public health services, and is responsible for health insurance organization that provides services too. The Ministry of Higher Education is however responsible for health profession education (medical, nursing, dentistry and pharmacy etc.) and also runs university teaching hospitals. Public health expenditure is low and has pluralistic and complex financing mechanisms: tax-based financing, health insurance and fee for service through out-of-pocket expenditures. To achieve universal coverage, Egypt is rolling out a new insurance scheme, currently being piloted in Suez Governorate, based on a ‘family physician model’ which will separate financing institutional oversight of all public entities involved in providing health services, limiting coordination between the various branches (World Health Organisation, 2013a). (Ministry of Health and population, 2008).

Organization of the Health System in Egypt

Expenditure on health is divided in the following manner: 36% goes to pharmaceuticals, 19% to services provided by the MDHP, 18% to the private sector, 10% to university hospitals, 8% to services provided by the insurance system, 6% to NGOs, and 3% to other public institutions. Private insurance is fairly limited in Egypt, as premiums are low and companies find it hard to turn a profit. Recent reforms have de-regulated the Egyptian health system, making the regulatory environment somewhat less restrictive, but still difficult to operate in (World Health Organisation, 2013a). (Ministry of Health and population, 2008).
Death and the Afterlife: Death is feared, accepted as "God's will," but believe death should be delayed by biomedical interventions. Critically ill patients may prefer to die in the hospital. Families will not openly grieve before death of family member; they will however grieve openly and loudly and a private room may be beneficial. After death Christians and Muslims try to bury the body the same day. Koran reading may be an indicator of the Islamic condolence sessions. Condolences are expressed without delay, and again after 40 days and after a year. Christian families may ask for a minister or priest to visit. Egyptian Muslims do not need an Imam present. Egyptian Muslims handle the body by same gender Muslim with modesty; oropharyngeal orifices are sealed with cotton, the body is covered with a sheet and turned towards Mecca (Lamar Soutter Library, 2016).

Magnitude of Cancer Care in Egypt

The Demographic Profile of Egypt

1. Population Trends

A. The Population Size of Egypt: Currently, Egypt is experiencing significant size, age structure changes that will have major implications for its socioeconomic development. The population size of Egypt increased from 44.9 million in 1980 to approximately 78.1 million in 2010. It is projected that in 2050, the population size of Egypt will reach approximately 121.8 million as shown in Table 1, (United Nations, 2012).

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>22,516</td>
<td>22,416</td>
<td>44,932</td>
</tr>
<tr>
<td>1985</td>
<td>25,257</td>
<td>25,089</td>
<td>50,347</td>
</tr>
<tr>
<td>1990</td>
<td>28,301</td>
<td>28,035</td>
<td>56,337</td>
</tr>
<tr>
<td>1995</td>
<td>30,731</td>
<td>30,437</td>
<td>61,168</td>
</tr>
<tr>
<td>2000</td>
<td>33,269</td>
<td>32,867</td>
<td>66,137</td>
</tr>
<tr>
<td>2005</td>
<td>36,081</td>
<td>35,696</td>
<td>71,778</td>
</tr>
<tr>
<td>2010</td>
<td>39,206</td>
<td>38,869</td>
<td>78,076</td>
</tr>
<tr>
<td>2015*</td>
<td>42,536</td>
<td>42,170</td>
<td>84,706</td>
</tr>
<tr>
<td>2020*</td>
<td>45,690</td>
<td>45,372</td>
<td>91,062</td>
</tr>
<tr>
<td>2025*</td>
<td>48,609</td>
<td>48,380</td>
<td>96,989</td>
</tr>
<tr>
<td>2030*</td>
<td>51,330</td>
<td>51,223</td>
<td>102,553</td>
</tr>
<tr>
<td>2035*</td>
<td>53,933</td>
<td>53,967</td>
<td>107,900</td>
</tr>
<tr>
<td>2040*</td>
<td>56,410</td>
<td>56,590</td>
<td>113,001</td>
</tr>
<tr>
<td>2045*</td>
<td>58,688</td>
<td>59,000</td>
<td>117,689</td>
</tr>
<tr>
<td>2050*</td>
<td>60,686</td>
<td>61,111</td>
<td>121,798</td>
</tr>
</tbody>
</table>

B. Population Growth in Egypt: The growth rate of the population of Egypt has been decreasing since the period 1980-1985, where it stood at 2.28 per cent. It reached 1.56 per cent in the period 1995-2000 and slightly increased afterwards to 1.68 per cent in the period 2005-2010. The population growth rate is expected to continue declining and will reach 0.69 per cent in the period 2045-2050.

2. Indicators of Demographic Transition

A. Mortality Transition in Egypt – Life Expectancy at birth in Egypt gained 10 years from the period 1980-1985 to the period 2005-2010, increasing from 59.9 years to 69.9 years. It is expected to reach 77.3 years in 2045-2050.

3. The Population Structure

A. Egypt’s Population Age Composition — The proportion of the population under 15 years of age has been decreasing since 1980 and is estimated to continue declining to 2050. At the same time, the proportion of the working-age population (15-64) has been increasing since 1980. It is projected to reach 66.9 per cent in 2040 then it will decline to 65.9 per cent in 2050. The proportion of the elderly population (65+) has also been increasing and is expected to reach 12.3 per cent in 2050. The age distributions in Egypt vary widely with major differences in the percentage of young and old as seen in Table 2. Hence, currently there is less cancer, but the expected change in demographics over the next 20-30 years is likely to result in an explosive increase in non-communicable diseases such as cancer and heart disease as shown in Table 2.

B. Changing Age Structure — In 1950, the pyramid had a wide base signalling the structure of a young population. In 2050, the pyramid is expected to narrow down.

Table 2: Egypt's Population Age Composition

<table>
<thead>
<tr>
<th>Year</th>
<th>0-4</th>
<th>5-14</th>
<th>15-64</th>
<th>65+</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>15.1</td>
<td>24.5</td>
<td>55.6</td>
<td>4.8</td>
</tr>
<tr>
<td>1985</td>
<td>15.2</td>
<td>24.8</td>
<td>55.8</td>
<td>4.6</td>
</tr>
<tr>
<td>1990</td>
<td>14.7</td>
<td>24.8</td>
<td>55.9</td>
<td>4.6</td>
</tr>
<tr>
<td>1995</td>
<td>12.6</td>
<td>25.3</td>
<td>57.1</td>
<td>5.1</td>
</tr>
<tr>
<td>2000</td>
<td>11.8</td>
<td>21.3</td>
<td>59.2</td>
<td>5.3</td>
</tr>
<tr>
<td>2005</td>
<td>11.2</td>
<td>21.3</td>
<td>62.0</td>
<td>5.5</td>
</tr>
<tr>
<td>2010</td>
<td>11.4</td>
<td>20.7</td>
<td>62.0</td>
<td>5.5</td>
</tr>
<tr>
<td>2015*</td>
<td>11.0</td>
<td>19.9</td>
<td>63.2</td>
<td>5.4</td>
</tr>
<tr>
<td>2020*</td>
<td>10.1</td>
<td>19.9</td>
<td>63.7</td>
<td>5.3</td>
</tr>
<tr>
<td>2025*</td>
<td>9.3</td>
<td>19.0</td>
<td>64.7</td>
<td>5.4</td>
</tr>
<tr>
<td>2030*</td>
<td>8.7</td>
<td>17.7</td>
<td>65.7</td>
<td>5.6</td>
</tr>
<tr>
<td>2035*</td>
<td>8.1</td>
<td>16.5</td>
<td>66.5</td>
<td>5.8</td>
</tr>
<tr>
<td>2040*</td>
<td>7.8</td>
<td>15.7</td>
<td>66.5</td>
<td>5.9</td>
</tr>
<tr>
<td>2045*</td>
<td>7.6</td>
<td>15.2</td>
<td>66.7</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Egypt: Elderly Population Trend 1950-2050

Figure 3: Egypt’s Elderly Population

Source: UN World Population Prospects 2012 revision.

Current status of cancer care in Egypt
An Overview and Profile of Frequent Cancers in Egypt

Table 4: The most frequent cancers in Egypt estimated using the results of the National Population-Based Registry Program of Egypt 2008–2011. (Ibrahim et al, 2014)

<table>
<thead>
<tr>
<th>Site</th>
<th>Percentage</th>
<th>Crude Rate</th>
<th>ASR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver</td>
<td>33.63</td>
<td>39.5</td>
<td>61.8</td>
</tr>
<tr>
<td>Bladder</td>
<td>10.71</td>
<td>12.6</td>
<td>21.1</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>7.0</td>
<td>8.3</td>
<td>13.4</td>
</tr>
<tr>
<td>Prostate</td>
<td>4.07</td>
<td>4.8</td>
<td>8.8</td>
</tr>
<tr>
<td>Thyroid</td>
<td>4.27</td>
<td>5.0</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast</td>
<td>32.04</td>
<td>35.8</td>
<td>48.8</td>
</tr>
<tr>
<td>Liver</td>
<td>13.54</td>
<td>15.1</td>
<td>24.4</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>7.0</td>
<td>8.3</td>
<td>13.4</td>
</tr>
<tr>
<td>Prostate</td>
<td>4.12</td>
<td>4.8</td>
<td>8.8</td>
</tr>
<tr>
<td>Thyroid</td>
<td>3.90</td>
<td>4.2</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# Includes trachea, bronchus, and lung tumours.
## Includes brain and nervous system tumours.

In men, liver and bladder cancers represented approximately 44% of cancer.

In women, breast cancer occupied the top rank accounting for 32.4% of all cancers, followed by liver which accounted for 13.5%.

In both sexes, the proportions and rates of the most frequent cancer sites by gender, there was predominance of liver, breast, and bladder cancer that represented approximately 46% of all cancers (Table 4).

Cancer Mortality Profile: According to World Health Organization - Cancer Country Profiles, 2014, 39,300 deaths were among men, and 33,000 deaths were among women as illustrated in Figure 4.
Table 5: Cancer treatment and palliative care


<table>
<thead>
<tr>
<th>Radiotherapy</th>
<th>Total high energy teletherapy units (per million inhabitants)</th>
<th>Number of radiotherapy centers</th>
<th>Number of radiation oncologists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>0.8 / million inhabitants</td>
<td>34</td>
<td>237</td>
</tr>
</tbody>
</table>

Table 6: Incidence rates of Cancer in Egypt (/100,000 populations) classified by region and gender for all cancer sites with and without non melanoma skin cancer (C44)

Source: Ibrahim et al, 2014

<table>
<thead>
<tr>
<th>Region</th>
<th>Man (95% CI)</th>
<th>Crude rate</th>
<th>ASR (95% CI)</th>
<th>Women (95% CI)</th>
<th>Crude rate</th>
<th>ASR (95% CI)</th>
<th>All (95% CI)</th>
<th>ASR (95% CI)</th>
<th>Male-Female Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Egypt</td>
<td>97.1</td>
<td>142.8</td>
<td>116.9</td>
<td>116.9</td>
<td>135.0</td>
<td>130.0</td>
<td>167.1</td>
<td>167.1</td>
<td>0.8:1</td>
</tr>
<tr>
<td>Middle Egypt</td>
<td>109.7</td>
<td>170.0</td>
<td>142.8</td>
<td>135.0</td>
<td>159.1</td>
<td>150.0</td>
<td>173.3</td>
<td>173.3</td>
<td>11:1</td>
</tr>
<tr>
<td>Lower Egypt</td>
<td>138.5</td>
<td>191.8</td>
<td>131.7</td>
<td>103.7</td>
<td>161.2</td>
<td>148.1</td>
<td>182.6</td>
<td>148.1</td>
<td>11:1</td>
</tr>
<tr>
<td>Calculated</td>
<td>117.3</td>
<td>148.1</td>
<td>111.7</td>
<td>104.9</td>
<td>170.0</td>
<td>155.5</td>
<td>183.5</td>
<td>155.5</td>
<td>11:1</td>
</tr>
<tr>
<td>Upper Egypt</td>
<td>96.6</td>
<td>142.1</td>
<td>116.9</td>
<td>116.9</td>
<td>135.0</td>
<td>130.0</td>
<td>167.1</td>
<td>167.1</td>
<td>0.8:1</td>
</tr>
<tr>
<td>Middle Egypt</td>
<td>110.6</td>
<td>171.0</td>
<td>142.8</td>
<td>135.0</td>
<td>159.1</td>
<td>150.0</td>
<td>173.3</td>
<td>173.3</td>
<td>11:1</td>
</tr>
<tr>
<td>Lower Egypt</td>
<td>136.7</td>
<td>189.1</td>
<td>131.7</td>
<td>103.7</td>
<td>161.2</td>
<td>148.1</td>
<td>182.6</td>
<td>148.1</td>
<td>11:1</td>
</tr>
<tr>
<td>Calculated</td>
<td>115.7</td>
<td>146.1</td>
<td>111.7</td>
<td>104.9</td>
<td>170.0</td>
<td>155.5</td>
<td>183.5</td>
<td>155.5</td>
<td>11:1</td>
</tr>
</tbody>
</table>

Figure 5 illustrates Age-Standardized Cancer Mortality Trends among men and women.

Egypt: Age-Standardized Cancer Mortality Trends

Figure 6 illustrates cancer incidence among men and women, breast was the highest among women, and liver among men.

Egypt: Cancer Incidence

Figure 6: Cancer Incidence

Egypt: Calculated age specific incidence rates for liver cancer

- Crude rates:
  - Men: 19.5/100,000
  - Women: 15.1/100,000
- ASR (world):
  - Men: 61.8/100,000
  - Women: 24.4/100,000

Figure 7: Calculated age specific incidence rates for liver cancer in Egypt 2008–2011

Egypt: Calculated age specific incidence rates for breast cancer

- Crude rates:
  - Men: 0.6/100,000
  - Women: 35.8/100,000
- ASR (world):
  - Men: 0.9/100,000
  - Women: 48.8/100,000

Figure 8: Calculated age specific incidence rates for breast cancer in Egypt 2008–2011

Egypt: Estimated Number of Incident Cancer Cases

- Figure 9: Estimated number of cases in Egypt (2013–2050)

Egypt: Cancer Cases and Causes for Increases

- Increased cases due to change in population structure
- Increased cases due to population growth
- Baseline cases (number of cases in 2013)

Figure 10: Estimated number of cases in Egypt (2013–2050) and causes of the increase in cases
During the period 2013–2050, the population of Egypt is expected to increase to approximately 1.6 times the 2013 population size. Applying the current age-specific incidence rates to successive populations would lead to a progressive increase in number of incident cases from 114,985 in 2013 to 331,169 in 2050, nearly three times the burden in 2013. This increase reflects both population growth and demographic change mainly due to the ageing of population. Population growth alone would increase the number of incident cases by 55.2% in 2015. This fraction progressively decreased to become 32.8% in 2050. The fraction due to ageing gradually increased to reach 67.2% in 2050.

Table 7: Estimated cancer incidence in the period 2013–2050 and causes of increase

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimated population</th>
<th>Est. number of cancer cases</th>
<th>% due to population growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>85,723 (100%)</td>
<td>7,798 (6.8%)</td>
<td>55.20%</td>
</tr>
<tr>
<td>2015</td>
<td>122,783 (106.8%)</td>
<td>3,494</td>
<td>26.40%</td>
</tr>
<tr>
<td>2020</td>
<td>137,872,522 (161.6%)</td>
<td>4,303</td>
<td>84.53%</td>
</tr>
</tbody>
</table>

Cancer Care Facilities in Egypt

Egypt has more facilities for cancer treatment than any other country in Africa; however, many elements of cancer control strategy still need to be implemented or improved. There are 32 Cancer management facilities including the biggest and the most specialized centre in the Middle East is the National Cancer Institute (NCI) which is affiliated to Cairo University. NCI is carrying research, education and clinical responsibilities and is considered the main reference in Egypt regarding cancer. Also, South Egypt Cancer Institute, Assiut University, Assiut, Egypt, 14 clinical oncology departments in the other public universities; ten cancer centres affiliated to the Ministry of Health in 12 governorates; 11 military cancer units that treat both civilian and military patients; oncology clinics at the hospitals run by the Egyptian Health Insurance Organization in most major cities; semi-private, NGO-operated cancer facilities; a charity-run Centre of Excellence of Paediatric Oncology in Cairo, and private-sector clinics and centers. In addition to surgery, most of these facilities have chemotherapy and radiotherapy capabilities (either linear accelerators or cobalt-60 units). Most centres have CT scanners and MRI machines, and the country has five PET-CT scanners (Stefan et al, 2013).

According to the WHO survey, Egypt had an operational policy, strategy, or action plan for cancer in 2010. However, no structured national cancer control programme as recommended by WHO is in place. Practical measures are needed for the optimum allocation of available resources to reduce the numbers of cancer cases and deaths and to improve quality of life for patients with cancer, through adoption of WHO recommendations (World Health Organisation, 2013b).

Approaches to Cancer Control

Prevention and Early Detection of Cancer

Although screening by mammography has been accepted as the gold-standard to ensure early detection of Breast Cancer, its cost-benefit ratio is still debated in the scientific community. It is important to keep in mind that even in the best screening settings, most deaths from breast cancer are not currently prevented by mammography screening. The latest reviews indicate a reduction of no more than 15% in BC mortality rate after introduction of mammography screening in western countries. Recent studies suggest that screening by Clinical Breast Exam could achieve a reduction of 52% to 88% of this magnitude with a better cost-effectiveness ratio.

Whatever screening tool is used, screening programs are resource-demanding and heavy-to-implement health interventions. Down staging programmes are an appealing alternative when resources are scarce, and should be considered as the first option in regions where a majority of Breast Cancer is diagnosed at late stage.

In Egypt, most cancers present at an advanced stage when cure is improbable even with the best treatments. Where still a vast majority of tumours diagnosed are above 2 cm, there is room for improvement by a down staging approach. Screening by CBE would be relevant to regions/ groups where stage distribution is good enough that down staging has no potential for major improvement. Reductions in mortality can result from both down staging in some part of the country and screening in other parts. However, Egypt should follow the WHO and BHGI guidelines which call for countries to conduct research and pilot projects prior to establishment of national programs, as neither benefit of screening, nor benefit of down staging programs have been formally demonstrated to date in any developing country. A major element in improving survival rates in many cancer has to be the much earlier stage of disease at diagnosis and this could brought about by public education and, in some cases, screening for pre-malignant lesions or early cancer (World Health Organisation, 2002).

In Egypt, primary health care workers are rarely provided with sufficient education about the early signs of cancer or where to refer suspected cases. This could be remedied by short training courses (ideally coupled to continuing education programmes), brochures or posters, and by establishing links between those who deliver primary health care and referral centres. Population based registries disease data are recorded. These data for breast cancers show that 25.5% of cases present at an early stage. However, it is clear that a large proportion of patients reaching the centres predominantly have advanced stage (stage III and IV) (Anwaar A, 2011).
The Breast Cancer Cairo Trial

The Breast Cancer Cairo Trial is a research project designed to evaluate the efficiency of screening by clinical breast examination (CBE) in the context of primary health care (PHC). The project has been designed by Professor Anthony Miller, Epidemiologist at the Public Health Sciences Department of Toronto University (Canada) and is headed in Cairo by Dr Salwa Boulos, radiologist in charge of the mammography unit at the Italian hospital until recently and now at El-Gallaa Hospital. The project has been financially supported by the Italian embassy in Cairo and the Department of Toronto University (Canada).

The study has been launched in other countries of the region (Yemen, Iran, Sudan) but Cairo was the first and is thus the more advanced centre of the study. The study was launched in May 2000 and has begun by a pilot phase (phase I) followed by a classical randomized trial (phase II and III).

The recruitment process is based on the presence of mobile vans where all of the above exams take place. A few weeks before a van is moved to a district, the population is informed about the importance of screening, thanks to posters and pamphlets distributed in mosques, churches and streets. Women eligible for screening (i.e. 45 years old or more) are contacted by phone or visited by health workers of the Red Crescent to encourage them to come to the vans. Only women without breast complaints are admitted for breast cancer screening. The symptomatic patients can go to the Women’s Imaging Unit at Al-Kasr Al-Ainy teaching hospital.

The pilot phase of the project has begun in October 2007. By February 2009, 25 different locations in Cairo, Giza and Alexandria governorates were visited; up to 22,000 women had been screened, 406 were referred for further diagnosis, 75 (18%) turned out to be false positive. Out of the real positive, 59 (18%) were operated, 73 (22%) refused diagnosis or treatment, 35 (11%) were not reachable and the remaining were into the diagnosis or treatment process.

One of the main problems encountered is to convince women who have a suspicious mammogram, to go for diagnosis and treatment as some refuse or disappear. Health workers from the NGO “Hope” are dedicated to this task. This kind of problem is frequently observed in developing countries when screening for breast cancer.

A TV media campaign about screening has taken place during the autumn 2008 to raise awareness about breast cancer and facilitate acceptance of screening, as well as a campaign on the local radio station Nogoom FM, a TV campaign should start soon (Salem D).

Table 8: Preliminary comparison of the stage distribution in the Cairo Trial

<table>
<thead>
<tr>
<th>Stage</th>
<th>Screened Group</th>
<th>Control Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>8%</td>
<td>1%</td>
</tr>
<tr>
<td>II</td>
<td>12%</td>
<td>4%</td>
</tr>
<tr>
<td>III</td>
<td>7%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Although follow up of all groups is yet to be completed, preliminary results are encouraging. Stage distribution in both screened and control groups are given in table 8.

Phase I (pilot study)

The initial target group was women 15-64 living in a geographically defined area (8 blocks) around the Italian Hospital (Abasseya district). In this pilot phase, 4116 women were contacted by social health worker (door to door visit) to attend designated PHC centres for Clinical Breast Exam at pre-determined date and time.

Of the women targeted, 60% (N=2481) attended, of those who attended 12% (N=291) were found to have abnormalities, of these 82% (N=236) attended the Italian hospital for diagnosis, and of these 34% (20 women) were diagnosed with Breast Cancer. This latest number corresponds to a quite high prevalence of Breast Cancer: 8/1000. Only one Breast Cancer patient was less than 40.

Phase II and III

The target group was restricted to women 40-64 and divided in 2 groups based on residential blocks (4 blocks each). Group A was offered active screening as in the pilot phase, the group B received only health education. Two additional areas were identified each with 5000 women aged 50-65 who were cluster randomized. The reputation of the trial preceded subject recruitment and there was higher acceptance than in the pilot phase, with 85-91% of women accepting to go for screening.

This trial is testing an approach to early detection which is promising for Egypt; it would be beneficial to extend this trial to other centres/towns of Egypt. However this requires important resources, especially human resources i.e. dynamic and dedicated local PIs, not mentioning international specialists.

It has to be mentioned that the idea of screening by clinical breast exam usually receives very little support from the medical community in low and middle income countries; Clinical Breast Exam is erroneously perceived as inefficient because of its low-tech nature. This is a misconception that could be tackled in Egypt by an increased publicity about the Cairo Trial (Miller et al, 2008).

Remarks on the Two Screening Experiments Taking Place in Egypt

The populations at risk of Breast Cancer in Egypt, i.e. the women above 45-year of age are approximately 8.5Mllons. The 22,000 women screened by the MOH mammography program in 1.3 years and the 15,000 women screened by the Cairo trial screened women in 8 years represent...
Liver Cancer Prevention

Many countries, including the United States, are experiencing a decades-long trend of increasing rates of liver cancer. The most common type of liver cancer, hepatocellular carcinoma (HCC), has a high mortality rate and limited therapeutic options, to which most populations have limited access.

The prevention of this type of cancer is especially urgent in developing countries. Among the major contributing factors to the development of HCC are chronic infections with hepatitis B (HBV) or hepatitis C (HCV) virus, and food contaminated with aflatoxins (toxins secreted by molds that infect improperly stored grains and nuts).

Fortunately, these factors are amenable to prevention, including protection against blood-borne viral infections, vaccination against HBV and improved food safety.

But would such strategies work in a developing country, such as Egypt, and why would Egypt be an appropriate place to test the effectiveness of liver cancer prevention programs?

The research group began studying HCC in Egypt more than 10 years ago, following ground-breaking work on HCV led by Dr. G.T. Strickland of the University of Maryland, Baltimore. Dr. Strickland’s studies of HCV in communities in Egypt revealed that the country has the highest rates of HCV in the world, the unintended consequence of a massive public health campaign that used injected drugs to halt the suffering from a type of parasitic infection (Schistosoma species) native to the Nile River valley.

The evidence suggests that improper sterilization techniques applied to the needles in that campaign resulted — over a span of 50 years — in the spread of HCV and other viruses to a large segment of the population. The situation resulted in massive epidemics of chronic liver disease, cirrhosis and HCC that have not yet reached their peak. The rate of HCC is about four times higher in Egypt than in the United States, and rising at a faster rate. Each year, over 15,000 Egyptians die from liver cancer.

Dr. Karima Elshamy mentioned that the major risk factors for HCC in Egypt, in addition to chronic infections with HCV and HBV, are occupational exposures to chemicals, pesticides and contamination of the diet with aflatoxins (alcohol abuse is uncommon due to religious customs that forbid drinking).

Each of these factors is preventable; yet beyond HBV vaccination, scant attention is being paid to preventive research or effective interventions, even in the more developed countries. In fact, a recent report by the U.S. Institute of Medicine concluded that the lack of knowledge and awareness of viral hepatitis among members of the public and policy-makers were major barriers to prevention.

Added to the burden of viral hepatitis in Egypt is the unsafe handling of pesticides in agriculture — its predominant industry — and the lack of awareness of safe food handling practices regarding aflatoxins. A program of health education focused on these and other risk factors for HCC could deliver appropriate information at low cost, aimed at empowering households to interrupt the current cycle of viral hepatitis transmission and carcinogenic exposures.

Over the long term, this approach could be used by many countries to reduce the human, economic, and societal costs of this fatal and increasingly common type of cancer.

The Egyptian Society for Promotion of Women’s Health (ESPHW) is a non-profit organization, non-governmental organization under the Ministry of Social Solidarity, was established in June, 2009. Dr. Karima Elshamy is the founder and executive director. The aim of establishing ESPHW is to improve and promote the health of women, increase women’s awareness regarding many diseases, especially cancer awareness, control and prevention, reducing cultural barriers and detecting cancer as early as possible, also for education of people, healthcare personnel, and research.

ESPHW is a member of Alliance of African & Mediterranean French Speaking Leagues Against Cancer.

Fakou and Port Said program

A programme in the rural region of Fakou and the urban region of Port Said to use local resources to increase awareness of breast cancer and its treatment by organizing home visits from primary care workers and meetings with local women resulted in a substantial reduction in cases of advanced breast cancer. About 20% of breast cancer cases in Port Said were amenable to conservative breast cancer surgery in 2008, and the number of stage III and IV cases had halved by 2004—08 compared with 1992—03. Conversely, early detection programmes without access to treatments would be fruitless and frustrating for both patients and health professionals.

The Breast Cancer Foundation of Egypt (BCFE)

The Breast Cancer Foundation of Egypt was established in 2003 by a small group of health care professionals, survivors and public spirited citizens as a non-governmental, non-profit organization under the Ministry of Social solidarity. At that time, there was no established Breast Cancer awareness governmental program and no other NGO was working in this area. The public in general was not receptive to information about cancer. The topic was considered taboo in Egypt.

The BCFE philosophy is to advocate for BC awareness and services by serving the public in a manner that generates happy clients and positive recognition. BCFE partners with the National Cancer Institute (NCI) for teaching health care professionals. It is a mutually beneficial arrangement that does not involve the exchange of money.

In the past few years BCFE has undertaken educational presentations and opportunistic screening programmes wherever asked for; i.e. private companies and ministries. The BCFE staff designed the screening program, all the tools for implementing it, the training program for doctors and nurses to provide screening services. BCFE surveyed the facilities of hospitals that wanted to establish an early detection clinic and recommended changes to support a good patient flow, privacy and efficiency. These services were provided free of charge to any facility requesting this assistance. The cost was supported by the sponsored screening program.

BCFE deals directly with many patients. Quick referral mechanisms and the link to treatment services are ensured. Poor patients are referred to free clinics of NCI. If they are covered by insurance they are advised WHERE and WHO to go to. If they do not want to go to NCI and are not covered by insurance, BCFE arranges for treatment for them at a low cost facility, or through a doctor that will charge reasonably.

The Egyptian Society for Promotion of Women’s Health (ESPHW)

The Egyptian Society for Promotion of Women’s Health (ESPHW) is a member of Alliance of African & Mediterranean French Speaking Leagues Against Cancer. respectively 0.26% and 0.17% of this target population. Such percentages are a little demoralizing in view of the dedication, effort and resources which were put in these two screening programs. However these programs are pilot studies and they are not aiming at a rapid national expansion, especially the Cairo Trial which should be viewed as a research project, but their results raise some concerns about the feasibility of a national screening program in a country like Egypt in a foreseeable future (Miller et al., 2008).

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To fit the specific needs of Egyptians in the context of their society and culture, a community-based health education approach tailored to the population at risk for cancer would offer many advantages. Community-based participatory research involves members of local communities in all aspects of a study from design to dissemination to ensure that the proposed intervention reflects the specific needs of the communities, and to strengthen the capacity of the community to implement public health activities. Moreover, the engagement of peer educators to deliver the health education program, which has been shown by Sarah Daliglish and others to be highly effective in such issues as tobacco prevention and reproductive health interventions, would be highly innovative in the context of HCC, and expansion of the national, multicultural response to viral hepatitis. This plan builds on what has already been achieved and is based on the best epidemiological estimations of viral hepatitis in Egypt and the latest scientific knowledge (Shaalan M, personal communication).

The National Committee on Viral Hepatitis, under MOHP, mandated the development of the Control Strategy 2008-2012 to ensure the strengthening and expansion of the national, multicultural response to viral hepatitis. This plan builds on what has already been achieved and is based on the best epidemiological estimations of viral hepatitis in Egypt and the latest scientific knowledge (Shaalan M, personal communication).

Egyptian National Control Strategy for Viral Hepatitis 2008-2012

The National Control Strategy for Viral Hepatitis is the first comprehensive approach to reducing the prevalence, incidence, and burden of disease associated with hepatitis B and C in Egypt. It represents a comprehensive, multisectoral response to the challenge of this major public health issue and is informed by the latest medical and scientific research on viral hepatitis in Egypt. The Strategy seeks to provide guidance to various government ministries and agencies, as well as to non-governmental partners, in order to ensure coordination and cooperation among them. The plan has been elaborated in concert with the Egyptian National Committee on Viral Hepatitis and in consultation with officials from the Ministry of Health and Population, the Ministry of Higher Education, various United Nations agencies and the WHO (Geneva and Cairo), as well as researchers at Egyptian universities and other local and international stakeholders involved in the fight against viral hepatitis (Ministry of Health and Population, 2008).

Research

One of the most successful elements of the fight against viral hepatitis in Egypt has been the creation of an international research network called the Liver Disease Research Unit (LDRU). The network brings together Egyptian, French, American, Swedish and Finnish universities and research institutes. External funding has been provided by USAID, the National Institutes of Health (USA), the European Commission, the French ANRS and Ministry of Foreign Affairs, and the Welcome Trust, among others.

Diagnosis and Treatment of Cancer

Viral hepatitis cannot be treated at the periphery of the health care system (e.g. in primary health care units), since its management requires special training for physicians and special equipment for diagnosis, follow-up, and drug storage. Some 100 hospitals in Egypt are currently equipped to treat patients with advanced liver disease, and there are approximately 400 specialists in advanced liver disease working mostly out of major cities. However, the quality of care and degree of access to drugs may be heterogeneous throughout these facilities.

Recently, 10 National Treatment Reference Centres were opened under the supervision of the National Committee on Viral Hepatitis, providing care for patients with HBV and HCV according to standardized guidelines and at subsidized costs. The Egyptian government has allocated 20,000 LE for the treatment of each HCV patient treated under HOI and at government expense, categories which include 94.1% of the 12,089 patients having started treatment as of February 2008. These outlays do not include financial expenditures required for monitoring, testing, facilities and related costs. The total cost to the government is thus a not insignificant percentage of the annual MOHP budget.

Transplants are currently available at approximately 10 public and private facilities, though donors can be difficult to come by and cadaveric livers are not yet available in Egypt. As of 2008, the cost is high (220,000-400,000 LE), though some government assistance is available (World Health Organisation, 2012).

Surveillance and Monitoring

The most recent population-level surveillance study is the 1996 /7 Egyptian household and workers national survey. It is impossible to say with any confidence how prevalence rates have changed in the years since the completion of this study.

There is currently no ongoing sentinel surveillance of chronic HBV and HCV, with the exception of monitoring of infection rates in Haemodialysis units as part of the national Infection Control Program. Additionally, the MOHP’s Epidemiological Surveillance Unit, established in 1999 with the cooperation of WHO, EMMRO and the CDC, coordinates surveillance of 26 communicable and non-communicable diseases.42 Cases of acute hepatitis A, B, and C are reported monthly from the network of 256 district surveillance units. However, surveillance figures do not accurately reflect the number of cases for several reasons: under-reporting due to time constraints on health care workers (HCV); the lack of a reliable IgM assay for acute HCV, making it more difficult to diagnose than HBV or HBV; and the fact that surveillance only covers MOHP facilities. Participation by private facilities is voluntary, and thus difficult to enforce. The laboratory support for surveillance also needs strengthening, as tests are not always fully equipped (World Health Organisation, 2012).

The National Cancer Registry Program of Egypt (NCRPE)

The National Cancer Registry Program of Egypt (NCRPE). Population-based cancer registry, it was initiated through a protocol of cooperation between the Ministries of Communication and Information Technology, Health, and Higher Education. The Supreme Committee of the Program decided to start by population-based registration of incident cancer cases and to explore the possibility of establishing a national cancer database through eventual inclusion of hospital-based cancer registries in due time. The registry program started in 2008 and covered 60% of the population. The total cost to the government is thus a not insignificant percentage of the annual MOHP budget.

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better planning and collaboration among schools could notably increase new physicians' knowledge of cancer detection and prevention. Nurses in Egypt has advantages and limitations. Medical education includes a unique system of three-year community-based public health training, but More than 1500 Egyptians have postgraduate qualifications in clinical and medical oncology. The medical and health-related educational system screening programmes. Success of the early detection programmes will rely on effective and optimal use of treatment possibilities.

Another factor relates to the phenomenon of reciprocity and filial piety (righteousness). As the parents grow old and the children come to maturity, the role of the provider is gradually passed to the children and in the twilight years, it often comes to pass that the family will make most of the decisions for the elderly ones. It is widely observed in local medical practice that in Egyptian families, the children often wish to conceal the diagnosis of cancer from the patient. At times, the diagnosis is explained to the children who stay behind in the consultation room after the patient leaves. This is entirely opposite to the grain of Western bioethics of medical confidentiality and patient disclosure. Indeed, this practice is not usually seen in clinics in the West where the very opposite occurs: the patient attends the consultation alone and certainly would hold the confidentiality of their medical information dear.

Confucius teaches that in a society, every person has a role and obligations to fulfill: In the context of cancer diagnosis, this phenomenon is par particularly acute. To a parent of a young family, a diagnosis of cancer immediately brings the burden of the possibility of being unable to fulfill his or her duties to raise the young and provide for the family. This may produce intense feelings of guilt, shame and anger. These reactions must be taken into consideration by the healthcare provider in relation to the patient.

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Amongst Muslims, again the concept of God's will influence the willingness to accept bad news and even mishaps and regard it as fate and thus be more forgiving to the carers. Research has shown that distribution of Breast Cancer is within the younger age group of Egyptian patients, the majority of cases occurring between 30-60 years of age. The median age at diagnosis is 49 years, one decade younger than the corresponding
Reduction in mortality from BC depends to a large extent on interventions aimed at early detection and treatment, including breast self-examination, clinical breast examination, and mammography (Holroyd et al, 2004). Lack of early detection programs is the primary reason for the escalation of the mortality rate from BC in developing countries (Shi et al, 2008).

Not seeking medical advice unless one is ill, followed by the women’s beliefs that physical checkups were not worthwhile were the most common personal barriers revealed by the present participants. In their study among women from rural Egypt (Younis et al, 1993), it was stated that many Egyptian women suffered in silence, endured much pain and discomfort before they would admit to being ill, and would mostly only seek treatment when their symptoms became severe (Solomon et al, 2007).

Unsurprisingly, a significant proportion of the women in the present study reported they were afraid of discovering that they had cancer, and embarrassment by the screening was a personal barrier. Generally, there are many personal obstacles for women to access prevention services. The fear of discovering cancer, embarrassment, and fear of the screening procedure were among the most commonly reported personal/cultural barriers to using the screening services (Younis et al, 1993) (Thompson et al, 2006). Spirituality and religion have been identified as major determinants of fear and fatalism with regard to BC in previous research (Thompson et al, 2006). Personal barriers can be overcome by promoting health seeking behaviour and educating the public on the importance of early detection of cancer with a message that empowers women to take charge of their own health.

The State of Oncology in Africa – 2015

The State of Oncology in Africa - 2015

Clinical Implementation

In most of the world, the majority of the cancer patients present with advanced disease. For them, the only realistic treatment option is pain relief and palliative care. Effective approaches to palliative care are available to improve the quality of life for cancer patients. Lack of access to basic pain relief continues to make living and dying with cancer in Egypt a very different experience from that in developed countries.

The National Cancer Institute (NCI) in Cairo was established in 1969 as a specialized institute, affiliated with Cairo University. In 2004, palliative care was included in the oncology medical training programme at the National Cancer Institute at the University of Cairo. In 2005, there were two organizations providing hospice palliative care in Egypt: the Cairo Evangelical Medical Society (which has hospice facilities in Cairo and Alexandria) and the National Cancer Institute (which puts an emphasis on cancer pain relief).

In 2010, the NCI, Cairo has cared for 18,156 new patients which comprised 70–80% of all cancer patients in Egypt. A total of 70% of all new cancer patients were diagnosed with an advanced stage of the disease. NCI’s first initiative towards the development of palliative care services was in 1981 when the first pain clinic was established as part of the Department of Anaesthesiology. This clinic handles 120–150 patients daily, while slow release morphine tablets are the only available pain medicine (Ministry of Health and Population, 2008). At the present, NCI is running a palliative care project in the outpatient patient department. This clinic operates on a 24-hour/day, 7-day basis, and its staff (multidisciplinary team) comprises pain management physicians, specialized nurses, clinical social workers, pharmacists, psychiatrists, dietitians and administrative manpower. In addition, a hotline service was established, thus enabling easier access to the experts on the team. In addition to the NCI, Cairo, the Kasr Elaini Cancer Centre in Cairo also runs a pain clinic and a palliative care service started in 2007. The new Children’s Cancer Hospital 57357 in Cairo runs paediatric palliative care services including psychological support. The Cairo Evangelical Medical Society provides in-patient and day care hospice services (opened in 2001), while similar services are provided by the Elshaba Elromany Hospice in Alexandria (Ministry of Health and Population, 2008).

Palliative care in Egypt is in an early stage of development with very few palliative care activities available even in all of the above specialized Centres. At this stage, research is crucial to develop suitable palliative care models with respect to the needs, culture, and resources in Egypt. In addition, a range of health professionals, other workers, carers and volunteers provide palliative care services: nurses, including registered and non-registered nurses with and without specialized palliative care qualifications, medical practitioners, including specialist palliative care physicians, hospital-based specialist palliative care trainees, hospital-based non-specialists and general practitioners (GPs), health professionals, including psychologists, phytotherapists, occupational therapists and pharmacists; volunteers; carers, including both formal and informal carers. While palliative care can be provided to patients in a variety of settings, a distinction is commonly made between care provided in hospitals (which includes hospices or dedicated palliative care wards) and the community (such as in the patient’s home or in residential aged care facilities).

Opioid consumption figures in Egypt are among the lowest worldwide indicating largely inadequate cancer pain control. Based on the data published in the most recent annual report of the International Narcotics Control Board, the average opioid consumption in Egypt during 2008-2010

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was 62 defined daily dosed for statistical purposes (SDD) per million inhabitants per day. With this Figure, Egypt was ranked 115th among 184 countries (Lammar Soutter Library, 2016).

In Egypt, palliative care and cancer pain control are at an early stage of development. Very few services are available, and there are many barriers to be faced, such as limited opioid accessibility and availability for medical use. Palliative care is still misunderstood among health professionals, cancer patients and the public at large. One reason to that is because the term does not obviously communicate the intent of this clinical discipline, which is lending better quality of life while combating cancer.

The Society for the Management of Pain was founded in Egypt in 1980. A postgraduate training program was subsequently established to equip physicians with advanced knowledge and skills in pain management. Parenteral morphine is locally manufactured whereas oral preparations are imported. One Egyptian experience that could have possible implications for other Muslim communities is that Egypt has had in training patients’ relatives to care for their patients in a home. A patient’s relative is selected as the principal caregiver and is then given basic teaching on the disease and some tips on patient care at home. The home caregiver is provided with a booklet that contains a daily observation sheet, which is completed by the caregiver and reviewed by the health professionals weekly (United Nations, 2012).

Practice: Only a few healthcare providers have adequate knowledge of pain assessment and management and palliative care, so, it is important to integrate pain and palliative care into the health units.

Egypt has National Guidelines for the management of acute and chronic pain, management of other physical symptoms. New guidelines are currently worked out for End-of-Life Care and for home-based hospice services. National guidelines for palliative care were not initiated till now. The NCI, Cairo offers MD and Master degrees in pain management and palliative care has been incorporated in the curriculum of the oncology nursing program in the same institute.

**Ethical, Religious and Cultural Issues**

All patients probably undergo the stages of acceptence of terminal cancer in the same fashion. The difference between Egyptian and Western cultural practices would likely be in the culturally specific coping strategies. Ultimately, the physician and other healthcare providers have to assess the patient in his cultural context and find out what would help the patient the most to go through the terminal phase of the disease. The cultural practices would likely be in the culturally specific coping strategies. Ultimately, the physician and other healthcare providers have to assess the patient in his cultural context and find out what would help the patient the most to go through the terminal phase of the disease. The cultural practices would likely be in the culturally specific coping strategies. Ultimately, the physician and other healthcare providers have to assess the patient in his cultural context and find out what would help the patient the most to go through the terminal phase of the disease.

In dealing with a patient, a physician must take into account the degree of his cultural inclinations as well as that of his family in order to communicate and provide best medical treatment effectively. Invariably, communication and empathy are indispensable in achieving this. In an increasingly westernising society, a physician should be wary of imposing generalized belief models on patients without first understanding their background and preferences.

Islam is the dominant religion in Egypt, and observant Muslims believe that having an illness represents an opportunity to enhance the Muslim’s degree or expiating personal sins. Yet, Islamic teaching encourages Muslims to seek treatment when they fall sick, as it is believed that Allah did not send down a sickness but rather a medication for it (Stefan et al, 2013). Muslims’ belief attributes to occurrence of pleasure and suffering to the will of Allah, and that every effort should be made to relieve suffering. Moreover, Islamic teaching considers the relief of suffering to be highly virtuous (World Health Organisation, 2013b). According to Islam, adults of both genders are granted the full right to accept or decline medical intervention. In reality, close family members are more often directly involved with the decision-making process. Generally, parents, spouses and older children, in descending order, have greater decision-making power than the other members of the family (World Health Organisation, 2002).

Islamic teaching encourages the community members to visit the sick and the sick to welcome their quests. Patients, therefore, may entertain a larger number of visitors during their hospitalization (Stefan et al, 2013). The use of drugs that might affect consciousness is strictly prohibited in Islam. However, medically prescribed opioids are generally permissible because of their necessity. Usually, patients and families accept the use of opioids for symptom management, provided the rationale for their use is clearly explained to them. Of great importance is to explain patients and their relatives the possible side effects, as there are great concerns about an imposed drawness (Anwar, 2011).

Issues that relate to end-of-life are compounded spiritually and ethically, and are open for interpretations. While discussing the prognosis of the loved one, Muslim families are often sceptical about receiving clear cut massages from the treating physician. The former are for the most part more comfortable receiving less concrete information and quite often would respond with ‘This is in Allah’s (God’s) hands, and we are not to predict the fate of the patient’ Such a response is largely due to the Islamic belief that the life expectancy of every person is only up to Allah, who is the one to determine the timing of death. Families, however, are very appreciative being updated as to the patient’s condition, in order to enable them to carry out the traditional funeral rites. Taking all of the above into consideration, caregivers in Egypt exercise all the precautions and sensitivity while talking to terminally ill patients and their families (Ministry of Health and population, 2008).

**Culture and Religion on and Communicating Bad News at the End of Life**

In Islamic ethics, family and community are intrinsically linked with each individual’s well-being (Salem El, personal communication). Similarly, in many Asian cultures, illness is a shared family event rather than an individual occurrence (Miller et al, 2008). The family provides a source of strength, hope and connectedness to others. Accordingly, the principle of autonomy does not bear the same weight as it does in many Western cultures and thus the family is the locus of the decision-making process (Miller, 2008). A Japanese study found that 46% of the population felt it was the family’s duty to provide a protective role in shielding the patient from a painful diagnosis. Equally, in Ethiopia and Saudi Arabia, information regarding a patient’s illness belongs to the family, who then use the information in the best interests of the patient. Physicists, consequently, respect the autonomy of the family as a unit (Miller et al, 2006).

**Methods to Improve Application of Palliative Care Principles**

Palliative care guidelines provide a framework for the care needed for patients with serious and life-threatening cancers. Approaches to improving the application of this care include education, training, and research endeavours.

**Palliative Care Education and Training**

Undergraduate education: The concepts of pain have been integrated into the education of nurses at some faculties and schools of nursing. Little attention has been paid to the education and training of health professionals on palliative care. Little information has received in undergraduate palliative Care Education. Most have acquired knowledge and skills after graduation.

Postgraduate Education: The concepts of pain, palliative care and end-of-life content are integrated throughout most of contents in Egyptian nursing faculties for postgraduate nursing curricula. In addition, assessment and management of palliative nursing is accomplished through
palliative Care clinical education, bedside teaching, and working in a variety of clinical areas, conferences and workshops. Some of Egyptian nursing faculties offer a hospice and palliative care courses. Students have the opportunity to choose and interact with palliative care team in hospitals, attend palliative care training program, and investigate palliative care and hospice care as delivered at hospital settings. The faculty of nursing palliative care training program and end-of-life (EOL) care focuses on the following contents:

- Pain Management that include: definitions of pain, current status of and barriers to pain relief, components of pain assessment, specific pharmacological and non-pharmacological therapies including concerns for different patients
- Symptom Management: Detailed overview of symptoms commonly experienced at the EOL, and for each, the cause, impact on quality of life, assessment, and pharmacological/non-pharmacological management.
- Ethical/Legal Issues: Recognizing and responding to ethical dilemmas in EOL care including issues of comfort, consent, prolonging life, withholding treatment, euthanasia, and allocation of resources; and legal issues including advance care planning, advance directives, and decision making at EOL.
- Cultural Considerations: End-of-life care, multiple aspects of culture and belief systems, components of cultural assessment with emphasis on patient/family beliefs about roles, death and dying, afterlife, and bereavement.
- Communication Essentials: Communication at EOL, attentive listening, barriers to communication, breaking bad news, and interdisciplinary collaboration.
- Nursing Care at the End of Life: Overview of death and dying in Egypt, principles and goals of hospice and palliative care, dimensions of and barriers to quality care at EOL, concepts of suffering and healing, role of the nurse in EOL care.
- Grief, Loss, Bereavement: Stages and types of grief, grief assessment and intervention, and the nurse’s experience with loss/grief and need for support.
- Achieving Quality Care: End-of-life challenge for nursing in EOL care, availability and cost of EOL care, the nurse’s role in improving care systems, opportunities for growth at EOL, concepts of peaceful or “good death,” “dying well,” and dignity.
- Preparation and Care: Time of death nursing care at the time of death including physical, psychological, and spiritual care of the patient, support of family members, the death vigil, recognizing death, and care after death.

Currently there is no postgraduate training in pain management or palliative care in Egypt. To effectively manage the large number of patients in need of palliative care services, Egypt should have adequate numbers of specialists in pain management and palliative care who in turn can support the primary care providers in the management of difficult and complex pain patients across Egypt. It is suggested that postgraduate training programs be developed for both doctors and nurses who wish to acquire special expertise in pain management and palliative care. Certification of healthcare workers in pain management and palliative care is being integrated into the undergraduate training provided by all medical and nursing schools in Egypt, and to be integrated into all examinations of doctors and nurses.

Research

Current Status

Egypt has significant quantitative and qualitative palliative care researches that were done by nursing, medical, psychological professionals. These researches are directing at improving the care of seriously ill patients and their families, improving the clinical practice, symptom control in advanced cancer, and interventions for ICU patients and families. These researches provide evidence-based practices geared toward the specific needs of patients, and to increase awareness of palliative care programs and the special needs of nurses who care for dying.

Need for Additional Research in Palliative Care

Further research studies are needed to explore strategies to decrease work-related stress in nurses caring for dying patients. Another beneficial study could involve clearly identifying the role of the nurse in paediatric palliative care programs and establishing protocols for staff development. These studies may also discover other innovative ways to increase satisfaction of patients, family members, and nurses overall. There is much need to increase a robust research agenda, targeting resource-poor areas, where disease burden and poverty are high and where health care is limited. Nurses are in a key position to do this; as they are globally advocating for increased awareness of palliative care as a public health issue and a human right, educating citizens about vaccinations and other preventive measures, and consulting in the development of competencies for this care. Targeted areas may include: Exploring the relationship of pain and other distressing symptoms on quality and quantity of life, independence, function and disability, and developing interventions directed at their treatment in patients with advanced and chronic illnesses; studying methods of improving communication between adults living with serious illness, their families and their healthcare providers; Evaluating models and systems of care for patients living with advanced illness and their families. Future research questions include the following: What are the barriers to pain and other symptom management related to palliative care? Why do some resource-poor countries have excellent availability of opioids for medical purposes and other countries do not? What role do nurses play in advocacy in promoting palliative care? What are the needs of dying patients and their families in Egypt? What interventions need to be developed/made available to meet these needs?

Challenges for Implementing Palliative Care

Healthcare systems and policies: the big challenge to Egyptian palliative care professionals is the development of hospice systems along with well-organized home-based services, lack of national health policies in support of palliative care development, focus on acute care, poor understanding and awareness of the role of palliative care in community, lack of legislation and accreditation of this new specialty discipline, lack of facilities and resources for palliative care, lack of communication with concerned departments, palliative and end-of-life care not prioritized in healthcare strategies, lack of long-term care and community services, no statistical data about how and where patients die, how many receive palliative care, and the characteristics of the caring process, and insufficient supplies and equipment. Raising the awareness and knowledge of palliative care among health care professionals and providers; monitoring and surveillance of the implementation of the national palliative care policy; introducing more core palliative care curricula at all levels of all health professional training, and educating the public.

Healthcare professionals: inadequate training for both health care professionals and general public about the necessity and importance of palliative care as integral part of cancer care, palliative care as a discipline is being seen as less prestigious, lack of interdisciplinary concepts and
teams, negative attitude towards caring for dying patients fear of opioid use (fear of side effects and/or fear of prosecution), resources focused on curative treatments and acute care, and perceived sense of failure

Patients and families: fear of addiction to opioids, fear of abandoning family members unrealistic hopes of cure, families also refuse admission to hospice which is considered as a place of death, isolated and unfriendly, diversity in religious interpretation of death and dying

Poor accessibility of essential palliative care drugs: general lack of opioids and unavailability of opioids in remote areas, very strict opioid prescription and dispensing policies, lack of other essential medications lists, and poor accessibility of essential palliative care drugs. Other challenges include changing the current opioid dispensing regulation to enable emergency opioid prescription by phone or fax, and the expansion of palliative care services to a larger number of patients and illnesses throughout the country.

Lack of relevant training to healthcare workers: lack of palliative care education programmes at all levels, Lack of updated education and clinical training to both physicians and nurses.

Summary and Recommendations

In Egypt, cancer is already an important health problem and will become increasingly important not only in terms of rank order, as infections are better controlled, but also in terms of incidence and mortality. The commonest sites were liver and breast among men and women respectively. Based upon the results of National Cancer Registry Program, Egypt is expected to experience a very large increase by 2050. The following recommendations could enhance the effectiveness of cancer care in Egypt.

1. The Ministry of Health and Population should recognize palliative care as a new subspecialty for nurses, and expansion of palliative care services to a larger number of patients and illnesses throughout the country, considering home-based palliative care service is urgently and badly needed

2. National Committee for Pain Relief and Palliative Care should be developed, and the latter committee should develop a national plan that involves: education, clinical practice including opioids availability, accessibility and disposal, research, public policy, and evaluating and monitoring care plans and activities.

3. Strengthening health care systems; focusing on patient centred care that optimizes outcomes for patients that are patient focused and are based on the patients need as opposed to prognosis, optimal care to optimize systems and access to services within available resources to provide the best care for the patient that is high quality and safe, also, management, monitoring and evaluation of inter-ventions to ensure they are effective and remain effective. Making real improvements in management will require the proactive efforts of many organizations, and we believe that education as well as discipline should be the cornerstone of efforts to improve cancer care in general and pain relief and palliative care specifically.

4. Education at all levels to be undertaken to all staff members in the oncology units throughout Egypt would gain basic practical training in dealing with cancer patients suffering from pain and other physical, psychological and spiritual symptoms. In order for such a plan to come about a ministerial-driven program is needed, whereby trained oncologists and oncology specialized clinical nurses be educated and trained in the following topics: communication skills between the clinical families, basic concepts of pain pathophysiology, pain assessment, choosing of analgesics and their dosing, management of visceral, somatic and neuropathic pain, management of other symptoms such as nausea, vomiting, constipation and delirium, wound care, management of last hours of life including dyspnoea, and how to overcoming cultural barriers. Also, to focus on subspecialties on the psychological, behavioural, physical, and spiritual

5. Effective cancer prevention programmes customized to the community should be fostered, particularly for prevention of hepatitis B and C infection, and breast cancer awareness and early detection, and encourage community share in the program by money donations, hospice places, volunteers and training.

6. Pain and palliative care education and training should be incorporated in the training curricula of all medical schools, family residents training program and all postgraduate oncology and other chronic disease nursing training program, also palliative care certified physicians are going to be central in coordinating this kind of care, clinical nurse specialists in palliative care, who provide palliative care at both institutional and community settings throughout the country are also needed.

7. Setting-up hospital-based palliative care support teams would be the biggest formidable challenge; as currently there are neither nurses nor physicians trained in palliative care within the public hospitals. These teams working within hospitals will offer an in-house consult-ant service, and facilitate their transfer to the community. The hospital-based teams will continually liaise with other services within the hospital as well as the home care teams to improve continuity of care, as well as provide education for both hospital and community health care professionals.

8. Many important breast cancer screening barriers have been identified among this group of Egyptian women. Women's perception of these barriers was associated with some sociodemographic characteristics. Identifying barriers to breast screening in the local commu-nity will help to remove those obstacles and design more culturally relevant strategies to increase the utilization of breast screening service and to ensure adequate breast care of these women.

9. Changing the current opioid dispensing regulation and ensuring the availability of this and other essential drugs,

10. Training and workforce capacity building are needed to improve research into cost-effective cancer control interventions and clinical trials.

References


Chattopadhyay S, Simon A. East meets West: cross-cultural perspectives in end-of-life decision making from Indian and German health care professionals.


Chapter 16f - Egypt
The State of Oncology in Africa – 2015

The Republic of Ghana is a country located in West Africa. It is bordered by Cote d’Ivoire on the west, Burkina Faso in the north, Togo in the east, and the Gulf of Guinea to the south. Initially colonised by the British under the name Gold Coast, it was changed to Ghana which means “warrior king” after attaining independence in 1957. The Country spans an area of 238,500 square kilometres and has a population of approximately 25 million. Ghana is divided into 10 administrative regions and English is the country’s official language which predominates in government and business affairs. Life expectancy is 65 years for men and 67 years for women. The country’s economy is considered to be low middle income and is dominated by agriculture, which employs about 40 percent of the working population. The literacy rate is 71.5% and government spends 5.4% of GDP on health.

<table>
<thead>
<tr>
<th>Table 1: Facts from Ghana</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capital</strong></td>
</tr>
<tr>
<td><strong>Population</strong></td>
</tr>
<tr>
<td><strong>Country code</strong></td>
</tr>
<tr>
<td><strong>Internet country code</strong></td>
</tr>
<tr>
<td><strong>GDP per capita</strong></td>
</tr>
</tbody>
</table>

Ibrahim A.S. Towards a National Population-based Cancer Registry for Egypt
Miller T, Boulos S. Personal Communication. Cairo.
About a decade ago, the health need of an individual was only attended to after initial payment for the service was made even in cases of emergency, known as the ‘cash and carry’ system. In order to promote universal coverage and equity in healthcare delivery services, the government of Ghana adopted the National Health Insurance Scheme (NHIS) in 2003, which was fully implemented in 2005. This was to assure equitable and universal access for all citizens to an acceptable quality package of essential healthcare services and to abolish ‘out-of-pocket’ payment. As of June 2009, about 67% of the population had subscribed to the NHIS and this figure is improving over time and currently officially stands at 75%.

The burden of non-communicable diseases is increasing rapidly whilst infectious diseases continue to pose major challenges. We still have high birth rates, decreasing death rates and by consequence an increase of the older population leading to increases in chronic and non-communicable diseases. The most significant of these are cardiovascular related diseases, diabetes and cancers. GLOBOCAN 2012 data estimates that 16,600 cases of cancer occur annually in Ghana, yielding an age-standardized rate of 109.5 cases per 100,000 persons. There is low awareness of cancer in Ghana and as a result most cases present at late stages. Early diagnosis and treatment efforts are frequently hampered by sociocultural influences including seeking traditional or spiritual resolve. Diagram below depicts the top reasons why patients with breast cancer diagnosed in Ghana absconded or presented with late disease.

<table>
<thead>
<tr>
<th>Reason</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical consultation</td>
<td>26</td>
<td>39.4%</td>
</tr>
<tr>
<td>Ignorance</td>
<td>19</td>
<td>28.8%</td>
</tr>
<tr>
<td>Fear of mastectomy</td>
<td>16</td>
<td>24.2%</td>
</tr>
<tr>
<td>Herbal treatment</td>
<td>13</td>
<td>19.7%</td>
</tr>
<tr>
<td>Prayers and prayer camps</td>
<td>13</td>
<td>19.7%</td>
</tr>
<tr>
<td>Financial incapability</td>
<td>12</td>
<td>19.7%</td>
</tr>
<tr>
<td>Fear of diagnosis</td>
<td>10</td>
<td>15.0%</td>
</tr>
</tbody>
</table>

The fear of mastectomy, use of herbal treatment, prayers and Chinese medicines accounted for more than 75% of reasons for either presenting late or absconding treatment. According to GLOBOCAN 2012 data (Globocan, 2012), cervical cancer is the top most frequent cancer in Ghana, however recent data from registries in Kumasi and Accra indicate that breast cancer ranks first.

General Health System

In the 16th century, traditionally, village healers and clerics were the primary care givers, offering herbal remedies. Western medicine was introduced by Christian missionaries to the Gold Coast in the 19th century.

Health care is provided by the government and largely administered by the Ministry of Health and Ghana Health Services. The healthcare system has five broad levels of providers: health posts which are first level primary care for rural areas, health centres and clinics, district hospitals, regional hospitals and tertiary hospitals.

Patterns of Patient Referral

Diagram below depicts the top reasons why patients with breast cancer diagnosed in Ghana absconded or presented with late disease.
Top Ten Cancer Cases Seen at KBTH By Sexes in 2012

<table>
<thead>
<tr>
<th>Site</th>
<th>OVERALL</th>
<th>MEN</th>
<th>WOMEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site N (%)</td>
<td>Site N (%)</td>
<td>Site N (%)</td>
<td></td>
</tr>
<tr>
<td>Breast</td>
<td>333 (29.3)</td>
<td>325 (40.8)</td>
<td></td>
</tr>
<tr>
<td>Breast</td>
<td>90 (26.5)</td>
<td>94 (26.0)</td>
<td></td>
</tr>
<tr>
<td>Cervix</td>
<td>194 (17.1)</td>
<td>194 (17.1)</td>
<td></td>
</tr>
<tr>
<td>Cervix</td>
<td>25 (7.4)</td>
<td>25 (7.4)</td>
<td></td>
</tr>
<tr>
<td>Colorectal</td>
<td>18 (5.6)</td>
<td>18 (5.6)</td>
<td></td>
</tr>
<tr>
<td>Colorectal</td>
<td>57 (5.0)</td>
<td>57 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Uterus</td>
<td>36 (3.2)</td>
<td>36 (3.2)</td>
<td></td>
</tr>
<tr>
<td>Uterus</td>
<td>17 (5.0)</td>
<td>17 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>17 (5.0)</td>
<td>17 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Bone</td>
<td>17 (5.0)</td>
<td>17 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>57 (5.0)</td>
<td>57 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Thyroid</td>
<td>17 (5.0)</td>
<td>17 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Thyroid</td>
<td>17 (5.0)</td>
<td>17 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Lung</td>
<td>9 (2.7)</td>
<td>9 (2.7)</td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>32 (2.8)</td>
<td>32 (2.8)</td>
<td></td>
</tr>
<tr>
<td>Bone</td>
<td>8 (2.4)</td>
<td>8 (2.4)</td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>9 (1.1)</td>
<td>9 (1.1)</td>
<td></td>
</tr>
<tr>
<td>Brain</td>
<td>9 (1.1)</td>
<td>9 (1.1)</td>
<td></td>
</tr>
</tbody>
</table>

Top Five Paediatric Cancers (and sub-types)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>2008-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lymphoma</td>
<td>112</td>
</tr>
<tr>
<td>Burkitt's lymphoma</td>
<td>49</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>10</td>
</tr>
<tr>
<td>Hodgkin lymphoma</td>
<td>12</td>
</tr>
<tr>
<td>Acute leukemia</td>
<td>64</td>
</tr>
<tr>
<td>Retinoblastoma</td>
<td>124</td>
</tr>
<tr>
<td>Wilms tumor</td>
<td>61</td>
</tr>
<tr>
<td>Soft tissue sarcoma</td>
<td>25</td>
</tr>
<tr>
<td>Bone marrow</td>
<td>17</td>
</tr>
</tbody>
</table>

Cancer Registry

Until recently, cancer statistics in Ghana were extrapolated from small studies and estimates replaced absent factual data. To circumvent this and also realising the need for accurate data to help formulate effective cancer control strategies, the teaching hospitals in Kumasi and Accra now have hospital based cancer registries, both of which in the very near future will be certified as population based registries. Preliminary data from the two registries are available as open access publications. Below is a diagram depicting initial data from the Kumasi cancer registry (Laryea et al, 2014).
National Cancer Control Plan

In partnership with various international organisations, Ghana rolled out a cancer control plan which was launched in 2015. The plan aimed at reducing cancer mortality by 30% through primary prevention, effective screening and early detection; improve effective diagnosis and treatment of cancer. The strategies outlined can only be fully achieved when cancer is recognized as a human resource menace by policy makers. Maternal and child health, HIV, TB and malaria are still considered priority and are comparatively allotted a big chunk of the limited health budget. Health education and screening starting from the grass roots i.e. community health workers will go a long way to achieve the goals of the plan. Referral patterns for cancer treatment need to be simplified to improve accessibility. Other important but overlooked aspects are the financial burden of cancer care as well as the inadequate numbers of skilled health personnel across the cancer continuum of care.

Prevention And Early Detection

Although the knowledge on cancer is generally low among the general population, it has considerably improved over the last few years especially in the area of breast, cervical and prostate cancers. Several health facilities in urban areas have equipment for mammograms, pap-smear and PSA testing but are lacking or limited in the rural areas. Individuals who want screening have to pay out of pocket for the service because these tests are not covered under the national health insurance scheme. There are ongoing governmental and non-governmental sponsored pilot studies in some rural areas for cervical cancer screening using Visual Inspection with Acetic acid, HPV DNA testing and vaccination of young girls against HPV infection. These pilot projects include home screening methods driven by community health nurses. The cost of vaccination is a limiting factor preventing full scale adoption as part of the national immunisation schedule. Ghana can proudly boast of 100% vaccination coverage for hepatitis B as a measure to reduce the incidence hepatocellular cancer. Most cancer cases seen in health facilities present with advanced stage and several reasons may account for this occurrence including the poor knowledge and attitude of people towards cancer. Most people attribute the symptoms of cancer to spiritual forces and other superstitious reasons and as such will seek help from a spiritual healer or herbalist first before reporting to the hospital when symptoms persist. Another reason is the poor access to healthcare especially in the rural areas causing people to self-medicate for several months to years before seeing a doctor. Delay due to misdiagnosis at the health facility is another major cause of late presentation which could be averted with inclusion of oncology in curricula of medical and nursing schools. In the past, delay in obtaining a histopathological report was a major cause of advanced stage presentation since pathological report could take up to several months. However, the establishment of many private pathology services coupled with the training and posting of pathologists to various regions in the country has led to marked improvement in the service.

Training of Health Care Personnel

There is paucity of skilled health personnel in the oncology spectrum across most of sub-Saharan Africa. The deficiency spans across medical physicists, nursing care, palliative care, surgical and radiation oncologists. With the help of the International Atomic Energy Agency, a branch of the United Nations; millions of dollars were spent on training required staff for setting up mainly radiation oncology facilities in some countries. Unfortunately due to poor remuneration and lack of facilities in their home countries, most preferred to seek greener pastures. With this experience, Ghana developed accredited undergraduate and post graduate programs for medical physicists, radiation therapists, radiation, clinical and paediatric oncology and most recently oncology nursing. Some of these programs involving radiation therapy are supported by the IAEA through regular externships. The West African College of Surgeons and Physicians and the Ghana College of Physicians and Surgeons are in the process of developing fellowship training programs for gynaecology oncology and surgical oncology. Under the PACT mission of the IAEA, the virtual cancer control university (VCCUNET) online programs are being developed to improve and standardise health care training in cancer care of which Ghana is a pilot site. The tables below summarize training for clinical oncologist in Ghana.

Medical Training in Ghana

<table>
<thead>
<tr>
<th>Medical school</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Development Studies, School of Medicine</td>
<td>Accra</td>
</tr>
<tr>
<td>KNUST School of Medical Sciences</td>
<td>Kumasi</td>
</tr>
<tr>
<td>University of Cape Coast Medical School</td>
<td>Cape Coast</td>
</tr>
<tr>
<td>University of Capetown Medical School</td>
<td>Cape Town</td>
</tr>
<tr>
<td>University of Allied Health Sciences</td>
<td>Ho</td>
</tr>
</tbody>
</table>

Post Graduate Training institutions
- West African College of Physicians and Surgeons established 1975
- Ghana College of Physicians and Surgeons established in 2003

Figure 3: Pie chart depicting total cancer cases seen in 2012

Lymph nodes of head, face and neck 2%
Urinary bladder 2%
Stomach 2%
Head, face and neck 3%
Endometrium 4%
Liver 7%
Ovary 6%
Prostate 4%
Breast 26%
Cervix 18%
Others 27%
simple oncology surgery such as mastectomy and lumpectomy with axillary dissection, total abdominal hysterectomy, and colorectal surgery. Complex surgeries are however referred to the teaching hospitals who have managed a high volume of cases. The lack of pathology services in regions results in poor handling of specimens, delays in reporting and subsequently late referrals for radiation and systemic therapies. There is a current drive to encourage young specialist surgeons and gynaecologists to sub-specialise in oncology.

Multidisciplinary Tumour Boards

The order of sequencing of cancer therapies can have an impact on outcome. Therefore all cancer cases should ideally be discussed by a multi-disciplinary team prior to any form of intervention. This is a major drawback for patients treated in private facilities with limited or absence of oncology specialists. Tumour boards for managing breast cancer were established in the teaching hospitals as far back as 2001. At the Korle-Bu teaching hospital in Accra, tumour boards for head and neck cancer, paediatric and gastrointestinal tumours are also active. The limited number of oncologists hampers the ability to discuss all cancer cancers prior to any interventions even though desirable.

Palliative Care

Even though palliative care is readily available to HIV patients in Ghana, other medical conditions were not considered to require palliative care. With the help of institutions like the American Society of Clinical Oncology, Africa (an NGO registered in the United Kingdom), Hospice Uganda and the Cross Roads Cancer Centre from Canada, palliative care services have improved substantially over the past couple of years. The team comprises a multidisciplinary group who sees patients and their families in the clinics, wards and include home visits. Starting originally from the teaching hospitals, the service currently has expanded to some regional hospitals. Frequent training workshops are conducted with the aim of expanding services further across the country. With the expansion of palliative care services, procurement, supply and utilisation of pain medications including narcotics have improved in urban areas but are still restricted by old myths of addiction, poor regulatory and prescription practices and sociocultural beliefs. Narcotics are almost nonexistent in the rural communities. This handicap can be overcome with the incorporation of palliative care and pain management in medical and allied health school curriculum.

Oncology Resources

### Table 7: Summary of oncology resources (2015)

<table>
<thead>
<tr>
<th>Resource</th>
<th>National control plan 2012-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobalt-60 teletherapy machine</td>
<td>1</td>
</tr>
<tr>
<td>Linear accelerators</td>
<td>3</td>
</tr>
<tr>
<td>Cobalt-60 teletherapy machine</td>
<td>3</td>
</tr>
<tr>
<td>Linear accelerators</td>
<td>1</td>
</tr>
<tr>
<td>MRI CT scans</td>
<td>1</td>
</tr>
<tr>
<td>High dose rate brachtherapy</td>
<td>2</td>
</tr>
<tr>
<td>High dose rate brachtherapy</td>
<td>2</td>
</tr>
<tr>
<td>Linear accelerating</td>
<td>1</td>
</tr>
<tr>
<td>Conformal 3D planning software</td>
<td>1</td>
</tr>
<tr>
<td>Oncology Drugs</td>
<td>2</td>
</tr>
</tbody>
</table>

### Duration of training

- Membership training in radiotherapy and oncology - 4 years
- Fellowship training in radiotherapy and oncology - additional 2 years

With the advancement in cancer care over the past few decades, developed countries have separate specialties for medical and radiation oncologist. In most of sub-Saharan Africa, physicians trained in both the delivery of systemic therapies and radiation therapies are necessary to bridge the human resource gap and reduce the ambiguity of the referral system. With the increasing complexity of managing individual cancers using radiation and systemic therapies, separate medical oncology specialisation will be necessary in the very near future. This is only achievable with the adequate development of human resource and facilities for training. Haematology is considered a separate specialty from medical oncology.

### Facilities for the Treatment of Cancer

There are three radiation therapy facilities available for the treatment of cancers:
1. National Centre for Radiotherapy and Nuclear Medicine, Korle-Bu Teaching Hospital, Accra (Fig. 4).
2. National Centre for Radiotherapy and Nuclear Medicine, Komfo Anokye Teaching Hospital, Kumasi.
3. Swedish Ghana Medical Centre, Accra (Fig. 4).

The establishment of the first radiotherapy centre in Accra was in fulfillment of a cherished dream dated as far back as 1960. During that period a cobalt machine was donated by the Canadian Government to be used for medical purposes. However, because of lack of funds to house it, the machine was donated to the Lagos University Hospital in Nigeria. Further attempts at establishing the facility in Accra began in 1975. In 1993, population based figures calculated with the help of the WHO and the International Agency for Research on Cancer estimated that Ghana had over 10,000 cases of cancer occurring annually, and that this could be expected to rise to 20,000. The regional need for cancer care was further exacerbated by the fact that the neighbouring countries of Côte d’Ivoire, Burkina Faso, Togo, Benin and Sierra Leone had no treatment facilities of their own. The Korle-Bu Teaching Hospital was selected as the site of the first IAEA supported radiotherapy project in Ghana. This facility treated its first patients in November 1997. The number of patients treated annually increased from 486 in 1998 to 1167 in 2014. Patients are referred from various parts of the country as well as other African countries. The waiting time to commence treatment ranges from 2-4 weeks due to the high patient load and sometimes the inability of patients to complete the necessary investigations prior to commencing treatment. The top five cancers are breast, cervical, head and neck, prostate and sarcomas in descending order. It houses a cobalt-60 teletherapy machine and a SPECT camera. Preparations are underway to install a newly acquired linear accelerator.

A second facility at the Komfo Anokye Hospital in Kumasi began treating patients in early 2004 and sees averagely seven hundred new cases yearly. It houses a cobalt-60 machine, 3-D planning system, simulator and a low-dose rate brachytherapy. A linear accelerator and high dose rate brachytherapy unit are yet to be installed.

The third facility, the Swedish Ghana Medical Centre is a private cancer centre established in 2012 and houses a dual energy linear accelerator and CT simulator. It treats an average of 100 hundred new cases per year of which one third are from neighbouring countries.

All these facilities have the expertise for systemic therapy administration with experienced clinical oncologists and oncology nurses. Some regional hospitals have the experience of delivering basic first line chemotherapy especially for breast cancer. Surgery for cancer patients is currently executed by general surgeons and gynaecologists with interest in oncology. As a result some regional hospitals have capabilities to do...
### Challenges and Way Forward

In a country burdened by communicable diseases: malaria, HIV and TB; the rising incidence of non-communicable diseases, such as cancers, is an additional burden that cannot be ignored. Unlike non-communicable diseases, the awareness of cancers is extremely low even amongst policy makers. Although a five year cancer control program was developed in 2011, many of the strategies are yet to be implemented. Civil groups have a strong role to play in cancer advocacy, which will sensitise policy makers and ensure prompt implementation of the strategy.

The cost of cancer care is not entirely covered by the national health insurance scheme. In a country where the minimum daily wage is approximately $2, the out of pocket cost of cancer care is borne with much difficulty and has led to many presenting late or defaulting treatment. There is a need for cost sharing cancer treatments, removal of high taxes on products, encourage local manufacturing of anticancer drugs and government lobbying of pharmaceuticals to reduce pricing.

There are inadequate number cancer treatment facilities and travelling long distances and renting accommodation, further leading to financial strain.

There are inadequate human resources to tackle the current burden. Investment into oncology health care personnel training is essential for a successful cancer plan.

In the absence of national data, it is difficult to convince policy makers, private and international organisation about the burden of cancer and the need for resource allocation as well as the proper roadmap to cancer control policy implementation.

### Summary

Ghana has made positive strides in improving cancer care over the past 15 years. These achievements could translate into controlling the cancer burden with further improvements in accessibility to appropriate cancer treatment facilities, skilled human resource, cancer education, early detection and screening for preventable cancers at the basic health care facilities and strengthening palliative care facilities at all levels of health care. Costs of cancer care should be shared through effective and realistic national insurance schemes. The negative impact of strong sociocultural beliefs can only be overcome through education of the citizens at all levels.

### References


Guinea

Namory Keita, Moussa Koulibaly

The State of Oncology in Africa - 2015

Chapter 16h

Guinea


Guinea, officially the Republic of Guinea, is a country in West Africa with a total area of 245,857 km², bordered by the Atlantic Ocean with 320 km of coast. The country is comprised of 4 different geographical areas: (1) a coastal area, Lower Guinea or Guinea Maritime, (2) a mountainous area, Middle Guinea which includes the massive of Fouta Djallon, (3) a savannah area in the north, the Upper - Guinea, (4) an area of forest in Southeast, Forest Guinea that is also mountainous with the maximum altitude of the country, 1,752m (Mont Nimba) rich in iron ore.

These four areas, called “natural areas” do not correspond to administrative areas, which are to the number from 7 they same constituted of 33 prefectures + the special zone of Conakry the capital city.

In 2015, the total population was 11,780,162 with a density of 47.9h/km². The population is relatively young with 42.0% being below the age of 15 years and only about 3.62% being 65 years and above. Most of this population (64%) lives in rural area and only 41% of the population is over 15 years (2010).

The schooling rate (primary school) (2006) was estimated at 51% and the adult literacy rate in Guinea is 41% according to the 2010 statistical report. 71% of households have access to safe water that is either piped or from boreholes and protected wells. Life expectancy from birth is 62.08 years. The number of physicians per 1,000 population was 0.1 in 2010. The number of hospital beds per inhabitant is 0.3 beds/1,000 inhabitants (2011) and health expenditure per capita (2012) is estimated at $32.

Guinea is a predominantly Islamic country with Muslims representing 85% of the population. Guinea’s people belong to twenty-four African ethnic groups.

Guinea’s economy is largely dependent on agriculture and mineral production. It is the world’s second largest producer of bauxite, and has rich deposits of diamonds and gold.

Cancer Registration

The cancer registry of Guinea is population-based, covering the capital city of Conakry. It was established in 1990 and is located in the Department of Pathology at the University Hospital of Donka, Conakry. There are approximately 1,56,844 inhabitants in the city according to the General Population and Health Census of 2014. The Guinean cancer registry has contributed significantly to the improvement of cancer registration and surveillance in Conakry through the improvement of data collection in spite of few means. It is the only registry in the country.

As in most developing countries, the burden of cancer is increasing in Guinea. During the years 1992-1994 the Guinean cancer registry reported 2,064 cases of cancer, corresponding to age-standardized incidence rates (ASRs) of 83.3 per 100,000 in men and 110.5 per 100,000 in women. 2,647 cases in 1996-1999, 1,161 in men and 1,486 in women corresponding to age-standardized incidence rates (ASRs) of 99.8 per 100,000 in men and 121.0 per 100,000 in women. For the period 2006-2010 a total of 3,146 cases were registered, including 1,949 cases among the residents of Conakry with for all three periods, a predominance in women.
Cancer Incidence

As elsewhere in West Africa, the most frequently occurring cancers among women in Guinea is cervix (40%), followed by breast (18%), liver (15%), ovary (4%), skin (3%) and stomach (2%). In men, the top six cancers are the following: liver (33%), prostate (26%), non-Hodgkin lymphoma (5%), non-melanoma skin cancer (5%), large bowel (4%) and stomach (3%). Liver cancer has been the most frequent cancer of either gender. In contrast to East and Central Africa, Kaposi’s Sarcoma is exceptional.

The trends in the analysis of these three periods reported show a steady increase in the incidence of cancer in general. This can be mainly attributed to the high frequency of infections and consequently to the steady increase of infections-related cancer (cervix, liver, prostate cancers…) for both men and women.

Indeed, a study published in 2009 on HPV infection among women in Conakry (Guinea), found an HPV prevalence of 50.8%. This rate was considerably higher than the one observed in areas at high risk of cervical cancer (such as South America, India and some parts of sub-Saharan Africa), with the exception of places where many women are infected with HIV.

Whereas HIV prevalence has steadily declined since 2001, it remains around 1.7% in the general population in Guinea. The high prevalence of HPV and probably hepatitis B may be at the basis of the increase in cancer incidence since both cancers cervix and liver are the most frequent in the country.
Childhood Cancer

The Guinea cancer registry has not published data on childhood cancers recently. The latest data available for the period 1996 to 1999 was published in 2003. During this period, childhood cancers represented 6.7% of all cancers recorded. A total of 193 childhood cancers (age 0-14) were registered, 60.6% of them having a histological diagnosis. The most frequent childhood cancer was lymphoma (64 cases representing 33.2% of the total), of which 34 cases (17.6%) were Burkitt’s lymphoma, with an age standardized incidence of 11.9 per million. Retinoblastoma represents 16.1% of all cancers (ASR 8.6 per million). In view of the low recorded rates and the few cases of leukaemia and brain tumours, it is likely that childhood cancers are under-diagnosed.

Cancer Mortality

In Guinea, the civil registration of deaths, involving certification of death causes, is almost non-existent. By consequence, the published figures are often of estimates which are, in most cases, underestimated. A process of improving the registration of births and deaths is ongoing in the country. According to WHO estimates, cancer mortality is very high and may result from a diagnosis at late stage. A delayed diagnosis may be due to the lack of organised screening or early detection programs. The deadliest cancers of either gender, could have a lower incidence with vaccination and/or screening. Cervix and breast cancers are the deadliest for women while it is prostate cancer for men and liver cancer for both sexes.
Patients often give up chemotherapy after a few courses due to lack of funds and also because the start time and/or the interval between the
cures are not respected. Another important reason is the continual shortages. Besides, there is no processing unit for chemotherapy in the private
sector.

Radiotherapy Resources

Currently, there is no radiotherapy equipment in Guinea. Patients, who can afford it, take in charge their trip out of the country (on the continent
or in Europe) to access specialised health care. Since 2006, efforts are underway to establish a National Centre of Oncology and to implement
a holistic management of cancers including radiotherapy facilities. Although, one radiotherapist is being trained, there is currently no trained
physicist.

Diagnostic Resources

There are only two histopathology services in the country. The first one is the National Centre of Pathology, established in 1990. It is staffed by two
pathologists and is located inside the National Hospital of Donka, which is the largest of the two university hospitals. The second histopathology
service, newly established in the China-Guinea Friendship Hospital, is a general state-owned hospital with a semi private management. It is also
staffed by two pathologists. These are the only two cancer diagnostic structures for the country. These laboratories use conventional cytoligic
methods and basic pathological anatomy. Fine needle aspiration is readily available in the specialised services of the two major teaching hos-
pitals and Friendship Hospital. Interventional radiology is still a common practice. The techniques of immunohistochemistry, cytogenetic and
molecular biology are not used. In the absence of suitable equipment, there is no possibility to carry out extemporaneous examinations.

As the brain drain is particularly important in this field, these services are affected by a severe lack of qualified staff. Indeed a number of pathol-
ogists sent abroad for further training never returned. Even those willing to come back to Guinea, end up returning to their host country when
faced with work difficulties and salary proposed. Another great difficulty is the insufficient availability of formol in private clinics and hospitals
inside the country. The improper storage of samples often leads to misdiagnosis. In these circumstances, the delivery time of cytology results
ranged from 48 hours to 7 days, and pathological examinations from three to six weeks. Currently, no private histopathology laboratory exists.

However, many biomedical analysis laboratories exist in the private sector and some of them are able to identify tumour markers: PSA, Beta HCG,
CA-125, CA 19-9, CA 15-3, carcinoembryonic antigen (CEA). National hospitals’ medical imaging services contribute to tumour diagnosis by con-
ventional radiography or ultrasound. All mammography services, as well as the MRI unit, are in the private sector in the capital city. Out of three
scanners, only one is in the public sector (Centre for the Diagnosis of National Social Security Fund). Above all, the main problem remains the lack
of radiologists and radiology technicians trained in these new technologies.
Availability of Oncologists

There are approximately ten organ specialists and one oncologist surgeon in the country. All are working in the two university hospitals. Two haematopoietic-malignancies: one at the University Hospital Donka and the second in the private sector. A medical oncologist and a radiation oncologist are currently being trained. Some residents in training in surgical specialty services perform surgical treatments for cancer pathologies. Some residents in training in surgical specialty services perform surgical treatments for cancer pathologies without receiving formal education.

The National Cancer Control and Prevention Program (NCCP)

In view of the high level of morbidity and mortality related to certain types of cancer (cervix, liver, breast, and prostate), cancer has been recognized as a public health problem in Guinea. Thus, the Ministry of Public Health of the Republic of Guinea has referred to cancer as a chronic disease and included its fight in both the National Health Development Plan (NHDP) from 2003 to 2012 and in the National Reproductive Health Program (NRHP) for gynaecological cancers.

A national plan against cancer (2004-2008) was written in 2004 in order to prevent cancers that can be prevented, treat cancers that can be treated and provide supportive care to people in need. This first document was developed through an extensive consultation process involving national and international stakeholders and coordinated by the national coordination of the fight against cancer. The PNLCC was formally adopted in April 2004.

The overall objective of the plan was to reduce the burden of morbidity and mortality from cancer through the implementation of cost-effective prevention and control interventions based on evidence, and to provide palliative care to improve quality of life of people living with cancer and their families. The specific objectives were to strengthen primary prevention, early detection, diagnosis and treatment, palliative / rehabilitation and monitoring and research. Although in recent years, significant progress has been made in the prevention of cervical cancer, the operationalization of this plan in these different components was not realised for lack of satisfactory financing.

In August 2010, a larger plan to fight chronic and non-communicable diseases (2011-2015) was written with an important component in the fight against cancer. This component has been delayed in its preparation and implementation. It was supposed to give priority to gynaecological cancers, liver cancers, prostate cancer in men and childhood cancer: in the case of the latter, little has been undertaken due to the lack of specialist in paediatric oncology. This plan will include sections on the revitalization of Cancer Registries, prevention, diagnosis, early detection, treatment, palliative care, quality assurance, training, assessment, monitoring, security and research. To accompany this plan, a strategy document for the fight against cervical cancer is being developed simultaneously.

Cancer Risk Factors and Prevention

In terms of risk factors, on the African continent including Guinea, it is estimated that 40% of cancers in men and 29% of cancers in women are related to infectious factors. In Guinea, cancer related infectious risk factors include hepatitis B virus, Human Papilloma Virus (HPV) and urinary schistosomiasis. In this context, the study of markers of aflatoxins exposure and hepatitis B infection in rural areas, conducted by the Institute for Research and Applied Biology of Guinea (IRBAG), showed that more than 95% of people surveyed have markers of aflatoxins exposure with varying levels according to the Natural Areas. Chronic carriage of AgHBS was estimated to approximately 16.7% in the same areas. Hepatitis B and C chronic infection are responsible for the occurrence of long-term hepatocellular carcinoma, itself responsible for 18.7% of all death related cancer in women and 31.2% in men in 2014.

In the context of primary prevention, some farmers have been trained in seed storage to fight against aflatoxins and, since 2006, vaccination against hepatitis B has been incorporated in the Expanded Programme on Immunization. In 2014 the coverage of hepatitis B vaccination among children was 63%.

Moreover, since cervical cancer incidence in Guinea is among the highest in Africa Region (51/100,000), HPV infection was investigated in women with and without cervical cancer in Conakry, Guinea.

HPV prevalence was 50.8% (32.1% for high-risk types) and relatively constant across all age groups (Fig.6). HPV16 was the most common type, both among the general population (7.3%) and, notably in Invasive Cervical Cancer (ICC) (48.6%). The others most common types in ICC were HPV45 (16.6%) and HPV18 (14.3%).

The heavy burden of HPV infection and severe cervical lesions in Guinean women calls for new effective interventions. Sixty-three per cent of cervical cancers are theoretically preventable by HPV16/18 vaccines in Guinea; perhaps more if some cross-protection exists with HPV45. However, for the moment, no vaccination program against HPV has been implemented in Guinea, even the demonstration project supporting by the Global Alliance for Vaccines and Immunization (GAVI) due to insufficiency of general immunisation coverage. The country is on the list of eligible countries in 2017.
In general, tobacco use is much more common in men than in women. Exposure to passive smoking, as in many other countries is not unusual because the restrictive laws on smoking in public areas and even in schools are poorly applied or not applied at all. Various surveys on smoking have been conducted in schools in Guinea in 2001 and 2008 by the Ministry of Health and Public Hygiene in collaboration with WHO Guinea and CDC Atlanta USA. These studies showed that among 17% of smoking students, 4% are women. Young people start smoking between 12 and 13 years, and 78% are in the age group of 16-20 years with an average number of 11 to 20 cigarettes a day. Similarly, these studies demonstrated ignorance among students of the real danger of tobacco. Despite everything, the incidence of cancers of the respiratory tract and oral cavity is low in the Guinean general population.

Regarding the interference of the industry, attention should be drawn to the different strategies used to promote the consumption of this harmful product. This is among other tobacco advertising, sponsorship of major events, pressure on public authorities including corruption.

For all these reasons, a number of achievements have been obtained: the development of many activities to improve access to information (Development of IEC campaigns, education for behaviour change). An anti-smoking law was promulgated by the President of the Republic of Guinea on the 10 December 2012 concerning marketing, consumption, advertising and sponsorship of tobacco and its derivatives. (Law L / 2012/039 / CNT of November 15, 2012). This law comes within the implementation framework of the UN Framework Convention for the fight against tobacco negotiated under the auspices of the World Health organisation (WHO). It must be recalled that the anti-smoking law banned smoking in public places and in public transport and advertising of cigarettes on all forms. Smuggling is harshly punished. Sellers are required, under pain of penalty, to inform the consumers about the risks. The offenses prescribed by that act, range from simple breach of crime to the misdemeanor: it remains to see the level of enforcement of this law that is far from perfect.
Alcohol Consumption

Alcohol consumption is considered worldwide as an important risk factor for several forms of cancer. In 2010, total alcohol consumption per capita in liters of pure alcohol in Guinea was 0.7%. 1.4% for men and 0.1% among women. For cultural and religious reasons, it is likely that these figures are underestimated because many drinkers deny the use of this product considered illegal by the Muslim religion practiced by 85% of the population. The country has a National Strategy and an operational action plan to fight against the harmful use of alcohol, in the integrated multi-sectoral policy, national NCD encompassing several NCDs and their common risk factors.

Diet and Exercise

Concerning nutritional health, obesity is an increasingly concern in Guinea, particularly in women since being coated is considered a criterion of beauty. In 2014, 5.9% of the population was considered obese; 8.9% among women and 2.8% among men. It is well established now that “junk food” has reached all countries of the world. The Republic of Guinea as most of the African countries is in transition in this field. Eating habits have changed. Traditional food is being replaced by diets too rich in fat and poor in fibre. The same Guinea STEP wise survey in 2009 had already shown that the consumption of fruit and vegetables is low in the studied population and almost 70 to 90% of those surveyed consumed less than 5 fruits or vegetables per day. In addition, the level of physical activity was found low. Between 60 and 65% of people in the 15-64 age range living in Conakry and in urban areas do not practice any physical activity. The combination of these three risk factors associated with other such as overweight, hypertension, and hyperglycaemia showed that among surveyed subjects aged 25-64, 30% of the urban population, 25% the population of Conakry and 17% of the rural population accumulates more than three risk factors for non-communicable diseases. By consequence, risk factors for non-communicable diseases are frequent in the Guinean population.

The nutrition Division of the Ministry of Health and sanitation organises nutrition education and awareness sessions on the consumption of fruits and vegetables via public and private audio-visual media.

The promotion of physical activity is another component of prevention supported by the Ministry of Health and Sanitation through the national program against non-communicable diseases. In this context a marathon is organised once a year. It is a great opportunity to perform greater exercise.

Cancer Screening Services

In Guinea, as in most of the countries of the continent, cancers are most often seen in advanced stages and involve therefore an important management, costly and often ineffective. Coverage in this type of specialised and high-level care remains very inadequate in the country. Accessibility for patients, who require the services, is not always assured and remains uncertain with regard to needs; because of insufficient technical and financial resources and qualified personnel. All this justifies the introduction of screening programs that are of major interest in the context of public health action. This screening can and should be easy to perform, simple, effective, inexpensive, enabling effective prevention.

Cervical Cancer

Conventional cytology is available in both pathological anatomy laboratories existing in the public sector in Conakry. However, due to a series of organisational problems, high cost, and lack of sufficient training and equipment to perform this type of procedure, there is very little demand from the population who is itself not sufficiently informed of the existence of this procedure for cervical cancer screening. In medical population in general, the smear is often considered a diagnostic test. Therefore, since the late 1990s and early 2000s, as part of the fight against cervical cancer, alternative screening methods by visual inspection with acetic acid (VIA) and iodine (VILI) have been tested and implemented with the assistance of the International Agency for Research on Cancer (IARC) under the ACCP. The results in terms of accuracy have been very encouraging and the results of many studies in the literature have finally convinced us to offer this method as a means of screening and trying different approaches favouring the development stage. This approach is currently being implemented with the assistance of other agencies such as USAD, WHO Africa through its non-communicable disease division and UNFPA, in order to obtain at least 50% coverage of the target population (25 to 65) within 5 years. In this context, peripheral screening units for cervical precancerous lesions are being integrated in the health sectors and referral hospitals associated with simple and safe treatment methods validated by the same studies. This refers to cryotherapy, the loop electro-surgical excision (LEEP) and cold section. Another method of treatment the “Cold coagulation” is being evaluated.

Breast Cancer

Conakry, the capital city, is the only city in the country that has the mammography equipment. Of the five available; one is in the public, in the centre of Diagnosis of the National Social Security Fund. Neither of the two university hospitals, where the management of this disease is carried out, has mammography equipment. Also very few women benefit from a clinical breast exam even in basic gynaecological services unless they are presenting symptoms. The self-examination also is not yet widely practised except in some intellectual women who are regularly informed by the media and/or internet. This situation is the result of ignorance of most of the women. It explains the huge delay in diagnosis as seen in these photos while the breast is an organ easy to reach.
For the organization of the screening programme, the reference network integrates gynaecology and obstetrics services. These services will be made gradually contribution for clinical diagnosis and for therapeutic management.

For all this to happen, a number of major activities are to be undertaken at each stage:

- Establishment of a training process
- Increase of public awareness
- Invitation to screening and screening clinic available every day in urban health centres (CSUs) and the public hospital of the city or municipality concerned
- Implementation of the system of diagnosis and treatment for positive cases
- Establishment of a referral system for both precancerous lesions and invasive cancers
- Establishment of an information, monitoring and evaluation system

It is for these reasons that the Francophone Regional Training Centre for Gynaecological Cancers Prevention has been taking place since 2001 in Conakry. Physical headquarters were built and opened in November 2006.

The main mission of the centre is to support the implementation of national and sub-regional strategies for the prevention of major gynaecological cancers specifically cervical and breast cancer. It supports programmes in education and awareness by informing the different strata of the population on the benefits of gynaecological cancers screening and improving services and research.

Since then, several types of options for care delivery were tested: integration of existing screening in the health system as described above; use of mobile clinics; family planning and cervical cancer screening campaign; and implementation in the primary health care of the algorithm No. 2 of the WHO PEN tool (Package of Essential Non-communicable Disease). The following objectives are pursued:

- Testing the feasibility of different patterns of health care services
- Testing different methods for increasing awareness
- Estimate the coverage rate of the population
- Implementing a practical based training process

The results in terms of participation of target populations, rate of positive tests (7.5 to 9%) and care of precancerous and cancerous lesions diagnosed (> 95% for pre-cancerous lesions and 55% for cancer) is very interesting.

Between 2004 and 2009 11,250 women were examined in the training centre. Among them, 180 carcinomas in situ (CIN) and 420 invasive cancers were found. The number of women treated for CIN was 160 (89%) and the number of women treated for invasive cancer was 252 (60%).
It was planned to repeat this type of campaign once a year to gradually reach all 33 prefectures and thus substantially increase screening coverage across the country. The strategy behind this project was to allow minimum equipment to be available in each city, in order to ensure continuity of screening and timely referrals for treatment. These hospitals would be given the means of diagnosis and treatment of precancerous lesions in a second phase. Unfortunately, the epidemic of ebola (2013-2015) considerably slowed the implementation of cervical cancer screening in the country. However, the regular daily activity of screening at regional training centres was maintained in Conakry even during the peak of the epidemic.

Other Cancers

There is no formal screening programme for other cancers such as colorectal cancer and prostate cancer. For the latter, some urologists request PSA testing and/or digital rectal examination for some men over 50 years of age who come in consultation for various reasons, but these measures are not systematic and are now known to be ineffective.

The absence of its screening programmes is due to lack of awareness of people but also to scarcity of resources. There is an absence of an effective national mechanism to motivate, organize and coordinate screening activities for other cancer sites. Another difficulty for implementing such prevention programmes is the almost total lack of reference system for confirmed cases towards reference centres. There is only one reference centre for prostate cancer (CHU Conakry), and none for other cancer sites.

Palliative Care

Palliative and rehabilitative care is strongly linked to the management of cancers in national programmes against cancer. Unfortunately, in Guinea, as in large parts of Francophone Africa, health systems face a major challenge: caring for more and more people who suffer from pain, breathing difficulties, nausea, anxiety and depression due to chronic diseases including advanced cancers. Without proper treatments, these symptoms often destroy the quality of life of patients and their families.

Most of these symptoms can be controlled with palliative care. However, these treatments are not accessible to the greatest number. It is estimated that each year about 912,000 people, including 214,000 children, need palliative care in Francophone Africa. Yet 16 Francophone African countries including Guinea (out of 22) do not provide palliative care to patients in need. While the local regulations are favourable to the use of drugs in medical treatment and palliative care, there is to date no real palliative care policy in Guinea. Guinea has signed the 1961 Convention and the 1996-2008 strategic plan implemented by the International Organization of Narcotics Control Board (INCB). The Ministry of Health conducted registration of opiates on the National List of Essential Medicines used in hospitals and different levels of the health pyramid. This represents a significant gain in the context of introducing palliative care in the country.

Cancer and HIV/AIDS in Guinea

Although HIV prevalence in West Africa is much lower than in southern Africa, the sub-region has several serious national epidemics. Thus, if the prevalence of HIV among adults (15-49 years) is less than 1% in Cape Verde, Niger and Senegal, it varies between 1% and 4% the adult population in other West African countries (1.7% in Guinea). The political will supported by the government and development partners has quickly extended the therapeutic management of people living with HIV.

The State of Oncology in Africa - 2015

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This figure shows a decrease in stages III and IV at diagnosis, probably due to regular screening activities in Conakry, even if there is still no ver-
table organised programme.

In 2012 integrated family planning (FP) campaigns and screening for cervical cancer have been started to increase the coverage of the target population. In Conakry, in three days of campaigning, 943 women were examined. Fifty-seven precancerous lesions and 17 cancers were found and treated.

Between September and December 2013, seven administrative regions and Conakry city have been covered by a new campaign integrating FP and cervical cancer screening. The stay in each regional capital was six days; the first three days were devoted to training and last three to the FP and screening activities during the same clinic. Specific objectives were to provide 3,000 women aged 25 to 49 years (300 by region + 900 for Conakry) with cervical cancer screening and to offer to 1,000 women aged 15-49 years (100 by region + 300 in Conakry) FP services.

A total of 5,673 women aged 15 to 60 and over were examined during this campaign, which was 89.1% more than expected. Among these women, 3,110 were aged between 25 and 49 (90.07%), i.e. the target population for screening. The peak of participation was observed among women in the age group of 35-39 years (18.5% of the population). The campaign was followed by a training workshop for regional trainers, which consolidated the gains and favoured anticipation of future campaigns. This training, which lasted ten days in one of the regional capitals, brought together 18 healthcare providers from seven regional hospitals (nine doctors, nine midwives and nurses).

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**Guinea: Invasive Cancer Distribution by FIGO Stage**

- **Stage I**: 42.38%
- **Stage IIa**: 0.48%
- **Stage IIb**: 11.43%
- **Stage III**: 25.95%
- **Stage IV**: 12.62%

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**Figure 14. Invasive Cancers Distribution according to the FIGO stage**
The daily management of screening activities should take into account a number of considerations:

- Under the responsibility of human resources activities in health structures concerned, the patient circuit should be developed and integrated into the routine activities of antenatal, postnatal and family planning (FP) consultations. This applies to public sector and private health structures having integrated PMTCT services.
- Healthcare providers will be trained and standard procedures will be developed for the realization of pre-test counselling, cervical cancer screening activities, and management of lesions detected. These procedures will be based on a document developed for this purpose and taking into account the level of the relevant health facility.

Integration involves that providers have the required capabilities to perform screening as well as other integrated activities of PMTCT:

- The cervical screening test should be systematically proposed during the counselling and the offer of HIV testing: during prenatal, post-partum and postnatal examinations.
- The patients, especially HIV positive, will be more targeted.

During both the prenatal care and the postnatal consultations, the principles must be:

- To offer cervical cancer screening to the greatest possible proportion of pregnant women;
- To ensure cervical cancer screening for all HIV-positive patients;
- To ensure a rational management in the implementation of the continuum of care through the proper use of allocated resources;
- To improve the coverage of cervical cancer screening and lighten the workload in PMTCT services. This requires to increase the capacity of awareness and counselling in the community but also in other services.

Results of these integrated activities are planned to be analysed in the coming years in order to measure their exact impact.

### Education of Cancer Care Professionals (Human Resources Development)

The country is very backward in the development of human resources and professionals of cancer management. There is only one radiation therapist in training, two haematologists in function, one medical oncologist and one surgical oncologist. Training specialists is not available locally and requires investments in foreign countries. Although there are organ surgeons with expertise in the surgical management of cancer, they are very few. There is currently no postgraduate education in this field in the Republic of Guinea.
Given the high incidence of gynaecological and breast cancers, which represent 50% of cancer cases in the country, a degree course for the holistic management of these cancers should be established first. In addition, a reference centre with equipment and financial resources should be created. This is essential to the implementation of an authentic institute of fight against women cancers in Guinea.

The training centre for the prevention of gynaecological cancers was implemented in the early 2000s in the Gynaecology Service of the Donka University Hospital in Conakry, and materialized by a freestanding building in November 2006. In addition to the training of trainers in prevention of gynaecological cancers, the centre provides permanent care of screening for breast and cervical cancer, and management of precancerous lesions.

NGOs in the Fight Against Cancer in Guinea

Regarding the role played by civil society in the fight against cancer, we must recognize that there are very few NGOs involved in this struggle in the country. A National League was created in the early 2000s; it is not functional due to lack of funding. A few other NGOs have sporadic activities with a very limited impact. These are, among others, the following ones:

- **"The Guinean Association for the fight against cancer (AGUICAN)"**: This NGO organises sensitisation sessions on breast cancer mostly during the global days of the struggle against cancer. To this end, the Guinea Alumina Corporation, a mining company, subsidiary of Emirates Global Aluminium (EGA) has been mobilised by the NGO to be involved in breast cancer screening and to provide some palliative care medicines. The association leads sporadically media activities of information and awareness in online newspapers. It also organised a skin cancer screening campaign for the albinos. This campaign aimed at examining 147 albinos in Conakry and in the surrounding towns. It helped find 15 patients with cancerous lesions, including four with advanced lesions. The latter have benefited from palliative and seven others were treated with the support of the association.

- **"Agir tous contre le cancer en Guinée"** also organises awareness campaigns. It arranged a special awareness campaign about prostate cancer in partnership with a local bank (UBA). Funds to buy some medicine for treatment were obtained.

- **"Fraternelle médicale Guinée"**, without specifically being a NGO to fight against cancer, was involved in 2006 in the community component of the fight against gynaecological cancers with the Guinean Society of Gynaecologists and Obstetricians. It was a punctual activity of community mobilisation of this NGO of young physicians very involved in the fight against HIV/AIDS. Women receiving care for HIV, prenatal care and family planning counselling were sensitised and mobilised to visit cervical cancer screening (VIA/VILI). Screening centres opened in the five municipal hospitals in Conakry with the support of the training centre for prevention of gynaecological cancers.

Although there is a clear commitment of these NGO to improve the well-being of cancer patients, their activities often lack coordination. So it is difficult to measure their real impact on the fight against cancers in the country.

Kenya is a low income country in Sub-Saharan Africa with a population of 43 million people and an area of 591,971 km². There are 10,239 registered medical doctors and dentists in the country. The distribution of the various cadres of health care professionals is given in table 1.

Table 1: Registered Healthcare Personnel per 100,000 Population, 2011 – 2014

<table>
<thead>
<tr>
<th>Cadre</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors</td>
<td>19</td>
<td>26</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Nurses</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Midwife Nurses</td>
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<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>20</td>
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<td>93</td>
<td>16</td>
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<tr>
<td>Laboratory</td>
<td>31</td>
<td>33</td>
<td>34</td>
<td>33</td>
</tr>
<tr>
<td>Clinical Officers</td>
<td>15</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
</tbody>
</table>

Cancer is ranked as the third most common cause of death in Kenya, after infectious and cardiovascular diseases. The annual incidence is about 28,000 cases with mortality estimated at 22,000 cases (Ministry of Public Health and Sanitation and Ministry of Medical Services, 2011). Over 60% of those affected are below the age of 70 years. In Kenya, the risk of getting cancer before the age of 75 years is 14% while the risk of dying from cancer is estimated at 12%.
Cancer prevention and control is jointly done by the Ministry of Health and Private sectors guided by the National Cancer Prevention and Control Strategy 2011-2016. The strategy outlines expansion of existing cancer centres and creation of four other regional centres (Ministry of Public Health and Sanitation and Ministry of Medical Services, 2011-2016) in addition to various strategies for prevention, early diagnosis, appropriate treatments, palliative care and survivorship care. Kenya has also started implementation of the Cancer Prevention and Control act of Parliament 2012 Chapter 246B (Parliament of Kenya, 2012). Some of the aspects covered by this law include 1) to promote public awareness about the causes, consequences, means of prevention and control of cancer 2) to extend to every person with cancer full protection of her/his human rights and civil liberties 3) to promote access to quality and affordable diagnostic and treatment services for persons with cancer and 4) to ensure sustainable capacity for the prevention and control of cancer. Once this law is fully implemented, all cancer prevention and control activities will be under the National Cancer Institute. This is a milestone in cancer control in Kenya.

Kenya: Most Common Cancers | Nairobi Cancer Registry - KEMRI

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Rate</th>
</tr>
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<tbody>
<tr>
<td>Prostate</td>
<td>17.3</td>
</tr>
<tr>
<td>Breasts</td>
<td>9.1</td>
</tr>
<tr>
<td>Stomach</td>
<td>7.3</td>
</tr>
<tr>
<td>Liver</td>
<td>5.3</td>
</tr>
<tr>
<td>Larynx</td>
<td>4.5</td>
</tr>
<tr>
<td>Pancreas</td>
<td>4.1</td>
</tr>
<tr>
<td>Trachea, bronchus, lung</td>
<td>3.4</td>
</tr>
<tr>
<td>Bladder</td>
<td>2.9</td>
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<tr>
<td>Loco</td>
<td>2.7</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>2.4</td>
</tr>
<tr>
<td>Uterine cervix</td>
<td>2.4</td>
</tr>
<tr>
<td>Brain, nervous system</td>
<td>2.3</td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>1.8</td>
</tr>
<tr>
<td>Mouth</td>
<td>1.6</td>
</tr>
<tr>
<td>Colon</td>
<td>1.6</td>
</tr>
<tr>
<td>Bone</td>
<td>1.3</td>
</tr>
</tbody>
</table>

The 20 most common cancer sites among Nairobi women are shown in figure 3. These 20 cancers account for 78.1% of incident cancer cases in women within the registry. The commonest are Breast, Uterine Cervix, and Stomach.

Cancer Patterns

There are two population-based cancer registries in Kenya based in the urban centres of Nairobi and Eldoret (African Cancer Registry Network). Nairobi City is the Capital of Kenya and has an estimated population of 4 million inhabitants, while Eldoret is a smaller city in Western Kenya. These two registries gather data on cancers cases seen at the two tertiary public referral centres namely Kenyatta National Hospital (KNH) and Moi Teaching and Referral Hospital (MTRH) in Nairobi and Eldoret, respectively.

Nairobi

Figure 2 shows the 16 most common cancer in the Nairobi population men. These 16 cancers account for 69.1% of incident male cancer cases in the registry. The top five cancer sites are prostate, oesophagus, stomach, and liver.
Kenya: Most Common Cancers | Nairobi Cancer Registry - KEMRI

<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>33.5</td>
<td>24.6</td>
</tr>
<tr>
<td>Cervix</td>
<td>9.5</td>
<td>6.8</td>
</tr>
<tr>
<td>Stomach</td>
<td>8.6</td>
<td>5.7</td>
</tr>
<tr>
<td>Esophagus</td>
<td>6.8</td>
<td>5.3</td>
</tr>
<tr>
<td>Colon</td>
<td>5.7</td>
<td>5.3</td>
</tr>
<tr>
<td>Ovary</td>
<td>5.2</td>
<td>5.0</td>
</tr>
<tr>
<td>Brain</td>
<td>5.0</td>
<td>4.3</td>
</tr>
<tr>
<td>Kidney, ureter, urea</td>
<td>4.6</td>
<td>4.3</td>
</tr>
<tr>
<td>Pancreas</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Bladder</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Oesophagus, unknown</td>
<td>3.0</td>
<td>2.9</td>
</tr>
<tr>
<td>Multiple myeloma</td>
<td>3.0</td>
<td>2.9</td>
</tr>
<tr>
<td>Rectum</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Non Hodgkin lymphoma</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>All childhood cancers</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Larynx</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Brain, nervous system</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Radiation therapy</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Women

Age-specific rates for women's cancers, Nairobi region

Children

Kenya: Childhood Cancers as per Nairobi Cancer Registry

Eldoret

In the Eldoret population, the most common cancers in men are Kaposi's Sarcoma (HIV-related), oesophageal carcinoma and non-Hodgkin's lymphoma (Figure 5) while in women the most common cancers are cervical cancer, breast cancer and Kaposi's Sarcoma (HIV-related) (Figure 6). Common childhood cancers include non-Hodgkin's lymphoma, leukaemia and nephroblastoma (Figure 7).
in Canada is training gynaecology oncologists (Master of Science in Gynaecology-Oncology). However, there is only one cobalt-60 radiotherapy machine at KNH. Plans are underway to install a linear accelerator at KNH and a cobalt-60 machine at MTRH.

In the private hospitals in Nairobi, there are five linear accelerators but access is limited because the cost of treatment is ten to 20 times the cost at KNH. Many public hospitals are negotiating for discounts for their patients but this is a difficult situation because private hospitals are business enterprises whose survival depends on profit. In an attempt to increase access to healthcare, the government has increased contributions to the national health insurance called National Hospital Insurance Fund (NHIF). While the NHIF policy is to cover all diseases, in practice NHIF does not pay for outpatient cancer services and pays selectively for in-patient services.

Both Nairobi and Eldoret have radiology and imaging equipments for cancer diagnosis ranging from X-rays, ultrasound, CT-scans to magnetic resonance equipment and mammogram equipment. These centres also have pathology departments including immunohistochemistry although frequent delays in specimen processing and reporting are experienced due to frequent shortages.

Cancer Prevention Activities

Carcinogens in Kenya

Environmental carcinogens in Kenya include infectious agents such as human Immunodeficiency virus (HIV), Kaposi’s Sarcoma associated herpesvirus (KSHV), human papilloma virus (HPV), hepatitis B and C virus, Epstein-Barr virus and Helicobacter pylori virus. Other carcinogens include alcohol, tobacco products, aflatoxins, solar radiation, processed meat and outdoor air pollution. Genetic pre-disposition to cancer and aging also play a role in carcinogenesis as many of the patients have no known pre-disposing factors.

Because of the high prevalence of infection-related cancers in Kenya, the country is focusing on several approaches to control infections. Kaposi’s Sarcoma, non-Hodgkin’s lymphoma and cervical cancer are AIDS-defining cancers. HIV still remains a significant public health problem in Kenya with prevalence rates of up to 30% in some regions (Kimanga et al, 2014). Measures to prevent these cancers include scaling up of early diagnosis of HIV/AIDS infections through structured and opportunistic voluntary testing and counselling. In Eldoret, there is a home-based HIV testing programme targeting individuals who may not be able to go to hospital (Kimayo et al, 2010). There is also prevention of mother to child transmission, post-exposure prophylaxis and early initiation of combined anti-retroviral therapy.

Medical circumcision to prevent HIV has also gained widespread acceptance and practice in the country especially among the traditionally non-circumcising communities (Balbearchi al, 2014).

Although cervical cancer is the most common infection-related cancer among women in the country, access to HPV Vaccination is still limited to a few demonstration centres in Eldoret and Nairobi (Vermandere et al, 2015). All accessible children get vaccinated against Hepatitis B as part of the pentavalent vaccine but few adults get the recommended booster doses after every 10 years.

Use of tobacco and alcohol is associated with development of various cancers of the aero-digestive tract. There are laws in the country that restrict advertising, purchasing and consumption of tobacco and alcohol but implementation is not only insufficient but also difficult because these are social-cultural and addictive substances.

Chapter 16 - Kenya


<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical</td>
<td>35.0%</td>
</tr>
<tr>
<td>Breast</td>
<td>20.7%</td>
</tr>
<tr>
<td>Kaposi Sarcoma</td>
<td>6.4%</td>
</tr>
<tr>
<td>Hodgkin Lymphoma</td>
<td>2.4%</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>2.3%</td>
</tr>
<tr>
<td>Nasopharyngeal</td>
<td>2.2%</td>
</tr>
<tr>
<td>Connective tissue</td>
<td>2.2%</td>
</tr>
<tr>
<td>Stomach</td>
<td>2.2%</td>
</tr>
<tr>
<td>Prostate</td>
<td>2.1%</td>
</tr>
<tr>
<td>Ovarian</td>
<td>2.0%</td>
</tr>
<tr>
<td>Kidney</td>
<td>1.9%</td>
</tr>
<tr>
<td>Multiple Myeloma</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

Figure 5-7. Cancers in men, women and children in Eldoret, Kenya

Infrastructure For Cancer Control

There are two public cancer centres in the country based at Kenyatta National Hospital in Nairobi and Moi Teaching and Referral Hospital in Eldoret. The country has nine radiation oncologists, eight medical oncologists and two gynaecology oncologists, all located in Nairobi and Eldoret. Haemato-pathologists also administer chemotherapy in various hospitals. While importation of chemotherapy drugs in Kenya is facilitated by the Pharmacy and Poisons board, making them available anywhere in the country, access to the drugs is limited because of high costs. Kenyatta National Hospital in collaboration with the International Atomic Energy Agency (IAEA) is training radiation technicians. Both Moi University and Nairobi University are developing curriculum to train medical oncologists and oncology nurses. MTRH is already training Medical Oncology Clinical Officers (Higher National Diploma in Medical Oncology) while Moi University in collaboration with Princess Margaret University...
Aflatoxin exposure still remains a challenge since most farmers grow and store their own cereals. There is no formal national aflatoxin control strategy.

Models of Universal Access To Cancer Care

The country uses different models of access to cancer care. In Eldoret, integration is preferred where cancer care is provided using infrastructure established for infectious diseases especially HIV care. Therefore cancer care is part of primary, secondary and tertiary health care. In Nairobi, cancer care is provided independently of the other diseases. While theoretically integration is cheaper, there has been no formal evaluation of the two models. The key to the success of both models is sustainability which depends on availability of cancer-related services, the ability of patients to pay for those services facilitated by an efficient and accountable public health insurance fund (World Health Organisation), the government’s commitment towards cancer control efforts, appropriate research and emphasis on manpower development and infrastructure growth.

References


Malawi

Malawi is a landlocked country in Sub-Saharan Africa located in the southern hemisphere. It is bordered to the north and northeast by the United Republic of Tanzania, to the east, south, and southwest by the People’s Republic of Mozambique; and to the west and northwest by the Republic of Zambia. The country is 901 kilometres long and 80 to 161 kilometres wide. The country has many striking topographical features, the biggest being the rift valley which is part of the east African rift valley. This valley runs the entire length of the country, passing through Lake Malawi in the Northern and Central Regions to the Shire Valley in the south. Malawi has a total area of 118,484 km² of which 80 percent is land and the other 20% Lake Malawi.

It is divided into three regions, the Northern, Central and the Southern region. The largest cities in the country are Mzuzu in the North, Lilongwe (Centre), Zomba and Blantyre (South). Lilongwe is the biggest and capital city of the country. Blantyre is the second most heavily populated city in the country and is also considered as the business capital of the country. There are 28 districts in the country. Six districts are in the Northern Region, nine are in the Central Region, and 13 are in the Southern Region (National Statistical Office, 2010).

The population of Malawi is estimated at 17 million as of 2016. The latest population and housing census done in 2008 determined the population to be 13,077,160 (National Statistical Office, 2010). Over half of Malawian population lives in rural areas. The majority of the population is young people with few elderly people (see figure 2). The life expectancy in Malawi is 58 years for men and 61 for women (World Health Organisation, 2013). The country has a free health care system to care for this growing population with a few private hospitals for those who can afford, mostly those on private medical insurance. The majority of the people in the country are poor and earn less than one dollar a day.

Malawis HIV prevalence is estimated to be 9.3-10.8% in the reproductive age group, 15-49 years (UNAIDS, 2014). In women the prevalence is 13% whilst in men the prevalence is 8% within the same age groups.
Cancer Epidemiological Data

The cancer burden in Malawi is reported to be on the rise. The Malawi national cancer registry recorded 18,946 new cancer cases from the year 2007 to 2010 (Msyamboza et al., 2012). In 2010, 28 government hospitals reviewed 10,300 cancer cases, mostly new cancer cases. The five commonest cancers in the country are Kaposi’s Sarcoma, cervical cancer, oesophageal cancer, non-Hodgkin’s lymphoma and bladder cancer.

In both surveys, cancer of the cervix was the commonest cancer in women (Figure 3) accounting for 45.4% of all cases followed by Kaposi’s Sarcoma (21.1%), cancer of the oesophagus (8.9%), breast cancer (6.6%) and non-Hodgkin’s lymphoma (4.1%). In men (Figure 2), of the 8,314 new cases registered in the study led by Msyamboza et al. (2012) in the same period, Kaposi’s Sarcoma was the commonest (50.7%) followed by cancer of oesophagus (16.9%), non-Hodgkin’s lymphoma (7.3%), prostate cancer (4.0%) and bladder cancer (3.7%).

In children less than 15 years of age non-Hodgkin’s lymphoma (mainly Burkitt’s) was found to be the commonest cancer accounting for 56.0% followed by Kaposi’s Sarcoma which forms 15.0%, cancer of the eye (7.3%), kidney (4.5%) and bone (2.2%).

In new registered cancer cases with ages between 15-59 years, Kaposi’s Sarcoma forms the majority of the cases (about 40%), followed by cervical cancer (28%); and cancer of the oesophagus (10%), whereas breast cancer contributes close to 3% (Msyamboza et al., 2012). In those aged above 60 years, cancers oesophagus constitute close to 28% of cases, followed by cervix (24.0%), Kaposi’s Sarcoma (10.0%) and prostate cancer (7.7%; Msyamboza et al., 2012).

Health Sector Human Resources

The Malawian population of 17 million has a doctor-to-population ratio of 0.2 doctors for every 10,000 people. The nurse-to-population ratio is 3.4 for 10,000 people. This represents one-third of the World Health Organisation’s recommended ten nurses per 10,000 people.

There is one medical oncologist, two radiation oncologists (clinical oncologists), four pathologists, two diagnostic radiologists and two haematologists in the country to care for this huge population (Figure 4). Surgical oncology has well-qualified surgeons in some specialty areas but still remains deficient in others fields. Pathology technicians are very few, and there are currently no cancer social workers practicing in the country.

The only nine certified oncology nurses are yet to be registered with the Nurses and Midwives Council of Malawi.
The histopathology turn-around time (TAT) varies from one facility to another in the country. The TAT in private laboratories is significantly shorter than that in public hospitals. In state hospitals, paid for samples take significantly less time than non-paid for samples. This information is well demonstrated by the figure 6 below. The laboratories coded anonymously A, B, C and D have their average TAT of five days, five days, 14 days and 21 days respectively for the paid for samples. The TAT for the non-paid for samples is ten days, 30 days and 40 days for labs A, C and D. In one study on TAT done at the biggest referral hospital in Malawi, the average TAT was 71 days for histopathology samples processed in the year 2010 (Masamba L, 2015).

Malawi: Histopathology Samples Turnaround Times (multiple laboratories)

<table>
<thead>
<tr>
<th></th>
<th>Paid for samples</th>
<th>Non-paid for samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paid for samples</td>
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<td></td>
</tr>
<tr>
<td>5 day turnaround</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10 day turnaround</td>
<td></td>
<td></td>
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<tr>
<td>14 day turnaround</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 day turnaround</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paid for samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 day turnaround</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 day turnaround</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5: Turnaround times for different laboratories for histopathology samples.

Screening and Early Detection

Cervical Cancer

There is a national cervical cancer screening programme, which was implemented by the Ministry of Health through the sexual and reproductive health unit which being run in most district hospitals in the country. This screen and treat programme for cervical cancer is done using acetic acid, VIA technique. This programme was started in 2004 and targets women aged 30-50 years old. According to the NCR report, by June 2011, 81 health facilities were registered to be providing cervical cancer services of which 50 were providing VIA only, 29 had VIA and cryotherapy whilst two had VIA, cryotherapy, major surgery and loop electrosurgical excision procedure also known as LEEP.
There are no programmes for routine screening of other cancers like breast cancer mammography, colorectal cancer colonoscopies, prostate cancer tumour markers like prostate specific antigen and gastric cancer endoscopies. However, most of the screening tests are available in the major public hospitals upon patient and/or physician request. There is opportunistic clinical breast examination in gynaecology clinics, at antenatal and V/A clinics. It must be pointed out this is not well structured and hence results or benefits are difficult to document.

Radiology

The country has five working CT scanners, one magnetic resonance imaging (MRI) and conventional and digital radiography. There are frequent breakdowns with the CT scans with poor ability to repair as mostly engineers have to fly from overseas leading to loss of scanning time. There is a new course of bio-medical engineers that is being offered by Malawi University of Science and Technology. This may address the issue and additional problems faced with other medical equipments.

Cancer Policy and Cancer Control Programme

Malawi does not have a National Cancer Control Programme (NCCP) or a cancer plan. In order to put the country on course with the WHO’s agenda there is a strong need for the country to have such a programme through the ministry of health. The importance of such a thoroughly set NCCP is in decreasing the incidence of cancer and at the same time improving the lives of cancer patients.

For the first time now there is an oncology chapter in the Malawi Standard Treatment Guidelines (MSTG). This chapter covers some of the most common cancers in the country and a general approach to their management. This document is critical in terms of guiding priority areas of clinical care for the clinical department of the Ministry of Health.

However, good progress is noted in the setting up of a non communicable diseases (NCD) unit and appointment of its manager. This has been spearheaded by the Ministry of Health. This section oversees all NCD activities and helps set and implement cancer policy. The unit has managed to come up with an NCD plan and task forces in different areas of NCDs including cancer. There has been a push for a tobacco and alcohol policy championed by the department of NCDs.

Available Treatment Modalities and Cancer Prevention Services

Medical Oncology Resources

The Centre shown in table 1 provide chemotherapy and surgical oncology services (except MASM-Med) with some cover of oncologists and nurses trained in handling chemotherapy. More capacity is concentrated at KCH and QECH. QECH is the largest facility in the country and is supported by a Medical School. There are other smaller facilities in Zomba and Mzuzu cities. Zomba and Mzuzu Central Hospitals mostly do cancer surgery but do not have established medical oncology. There is limited chemotherapy offered at Zomba and Mzuzu. Chemotherapy is very limited in smaller district hospitals and restricted to managing Kaposi’s Sarcoma with vincristine.

Surgical Oncology

Surgical oncology services are provided in all the central hospitals of the country and two major private hospitals. However Queen Elizabeth central hospital is the largest referral hospital in the country and has the biggest concentration of surgical specialists. There are neurosurgical specialists, orthopaedic surgery specialists, paediatric surgery specialists, head and neck, Ears / Nose / Throat (ENT) as well as general surgical specialists. Most of the surgical residents are undergoing training in the country, which leads to further increases in the number of surgical specialists. However, there is no specific surgical oncology specialization programme in Malawi.

Cancer surgeries are performed in both public and private the general hospitals. The complicated procedures are done at the four tertiary hospitals and big private hospitals. These procedures are done by respective surgical sub-specialties other than surgical oncologists.

Palliative Care Services

There is an established palliative care centre in Blantyre district at Queen Elizabeth Central Hospital and a palliative care hospital in Lilongwe with several outlets in surrounding districts. There are palliative care consultants with doctors and nurses working for these institutions. Both oral liquid morphine and morphine sulphate tablets are readily available throughout the year for pain relief in cancer patients and other chronic illnesses.

Cancer Registry

The Malawi National Cancer Registry (MNCR) was established in 1985 and is a population based registry. It has its office at the largest referral hospital, Queen Elizabeth Central Hospital in Blantyre. The population component of the cancer registry focuses on urban and rural Blantyre and the surrounding districts. Periodically data is collected from all district hospitals which are secondary health facilities and central hospitals which are tertiary health facilities nationwide. Some data is also collected from private hospitals providing cancer diagnostic services in the country. This cancer registry takes into account both urban and rural populations. The registry was started with support from International Agency for Research on Cancer. The MNCR is affiliated and supported by the African Region Cancer Registry Network. The most recent nationwide data

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Table 1: Chemotherapy Centres in Malawi

<table>
<thead>
<tr>
<th>Lilongwe City facilities</th>
<th>Blantyre City facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kamuzu Central Hospital</td>
<td>Queen Elizabeth Central Hospital</td>
</tr>
<tr>
<td>MASC-Med One</td>
<td>Mzuzu Advent Hospital</td>
</tr>
</tbody>
</table>
The estimated cost of treatment for a cancer patient locally is about 1,000$. The cost of treatment for radiotherapy and concomitant chemotherapy is roughly 6,000$ when patients have private insurance or use their own money; and up to 30,000$ when the treatment is State-funded.

The estimated cost of treatment for a cancer patient locally is about 1,000$. The cost of treatment for radiotherapy and concomitant chemotherapy is roughly 6,000$ when patients have private insurance or use their own money; and up to 30,000$ when the treatment is State-funded.

There is currently no school that has a postgraduate programme for training health care professionals in oncology. Oncology training is mostly done in South Africa. However, a postgraduate programme which will provide lessons in several oncology disciplines is expected in the near future at one of the local universities.

The main source of funding for cancer screening, diagnosis and treatment is through the State. The various non-governmental organizations outlined above supporting cancer care partner with governmental institutions to deliver care. The majority of the population is not on medical insurance. It is estimated that 15% of the population that is on private insurance accesses private cancer care within and outside the country when necessary.

Cancer Awareness

The level of knowledge of cancer in the community is suboptimal hence most patients present with advanced disease. Awareness campaigns are carried out in some communities and using media houses. Mostly the awareness targets early recognition of cancer symptoms and early presentation to the hospital. The Cancer Association of Malawi (CAM) which is an umbrella non-profit organization for cancer advocacy run by volunteers spearheads these cancer awareness campaigns. This is done in collaboration with the QECH Cancer Unit and at times MOH-NCD unit.

Training Of Professionals

There is currently no school that has a postgraduate programme for training health care professionals in oncology. Oncology training is mostly done in South Africa. However, a postgraduate programme which will provide lessons in several oncology disciplines is expected in the near future at one of the local universities.

The University of Malawi College of Medicine holds a grant from the Medical Education Partnership Initiative (MEPI, a funding programme administered by the United States National Institutes of Health – NIH) that is helping building the human resources capacity. This grant covers training of pathologists, technicians and public health scientists. Cancer care capacity will be greatly enhanced in Malawi once the trainees supported by this grant graduate.

Health Funding

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The estimated cost of treatment for a cancer patient locally is about 1,000$. The cost of treatment for radiotherapy and concomitant chemotherapy is roughly 6,000$ when patients have private insurance or use their own money; and up to 30,000$ when the treatment is State-funded.

There are other registries, in Lilongwe, Zomba and Mzuzu, but these are pathology- or laboratory-based registries. Though these may highlight interesting institutional data, they fall short in terms of their applicability to the community. Their data cannot be used for programming and calculation of cancer survival in the population. The data from the various institutional laboratories feeds into the component of the national based part of the MNCR.

There is no mandatory reporting of a cancer diagnosis by physicians. Collecting this data is a demanding and costly task for the personnel. Lack of vital statistics, as a legal mandate, is another operational challenge that compromises the accuracy of our cancer statistics. However, the Ministry of Home Affairs and the Department of National Statistics are implementing birth and death registration in the country. This may aid data quality in terms of vital statistics parameters.


Quality of Services and Ideal Requirements and Clinical Outcomes

The state of Oncology in Malawi is in its infancy with still so many challenges to be addressed. However, the landscape is quickly changing for the better. The implementation of the radiotherapy projects that are commencing will be a game changer in terms of cancer care and will surely tremendously improve care and outcomes. The implementation of these cancer centres needs to be done in the sphere of comprehensive cancer control to deliver more benefit by addressing all the important aspects of cancer control and fight. There is growing political willpower which if harnessed correctly would augment the scientific and clinical drive to improve the state of Oncology in Malawi. Malawi can definitely improve care and outcomes. The implementation of the radiotherapy projects that are commencing will be a game changer in terms of cancer care and will surely tremendously improve care and outcomes. The implementation of these cancer centres needs to be done in the sphere of comprehensive cancer control to deliver more benefit by addressing all the important aspects of cancer control and fight. There is growing political willpower which if harnessed correctly would augment the scientific and clinical drive to improve the state of Oncology in Malawi. Malawi can definitely improve care and outcomes.

Conclusion

The state of Oncology in Malawi is in its infancy with still so many challenges to be addressed. However, the landscape is quickly changing for the better. The implementation of the radiotherapy projects that are commencing will be a game changer in terms of cancer care and will surely tremendously improve care and outcomes. The implementation of these cancer centres needs to be done in the sphere of comprehensive cancer control to deliver more benefit by addressing all the important aspects of cancer control and fight. There is growing political willpower which if harnessed correctly would augment the scientific and clinical drive to improve the state of Oncology in Malawi. Malawi can definitely improve care and outcomes.

References

Mauritania is a West African country which borders the Atlantic Ocean. It is divided into 15 regions. The main cities are Nouakchott (political capital), Nouadhibou (economic capital), Kiffa on the road of Mali and Rosso on the border with Senegal. The area of Mauritania is 1,025,520 km² of which over 80% is located in the Sahara desert. The population is estimated to around 3,500,000 people as of 2015; 3,105,000 people were recorded in the latest census (2010). The population is 58% rural and 42% urban.

Table 1: General Facts

<table>
<thead>
<tr>
<th>Source: United Nation Development Programme, 2009</th>
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<tbody>
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<td><strong>Age distribution (2010)</strong></td>
</tr>
<tr>
<td>Under 15: 40.6</td>
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<tr>
<td>15–64: 56.7</td>
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<td>65+: 2.7</td>
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<tr>
<td><strong>Median age (2010)</strong></td>
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<tr>
<td>Total: 19.3</td>
</tr>
<tr>
<td>Men: (N/A)</td>
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<tr>
<td>Women: (N/A)</td>
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<td>Men: 55</td>
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<tr>
<td>Women: 60</td>
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<tr>
<td><strong>Birth rate (per 1000 live births, 2005-2010)</strong></td>
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<tr>
<td>Total: 33</td>
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<td>Men: 33</td>
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<tr>
<td>Women: 30</td>
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<tr>
<td><strong>Maternal mortality rate (per 100,000 live births, 2010)</strong></td>
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<td>Men: 201</td>
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<tr>
<td>Women: 115</td>
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<tr>
<td><strong>Literacy (%) (1999-2007)</strong></td>
</tr>
<tr>
<td>Total: 55.8</td>
</tr>
<tr>
<td>Men: 63.3</td>
</tr>
<tr>
<td>Women: 48.3</td>
</tr>
</tbody>
</table>

Health Services

The health system in Mauritania is pyramidal and consists of four levels. The central (national) level includes the Ministry of Health, the body responsible for the purchase of medications (Centrale d'Achat de Médicaments), the National Institute of Public Health Research, the Faculty of
Mauritania.

Mauritania has a total of 412 physicians, i.e. one per 8,495 people. There are 366 midwives, and 2,147 nurses. The government allocated 5% of its budget to health, which accounts for almost 75% of total health expenditures in the country. The spending per capita on health is 13$, which remains far below the WHO minimum recommended average (345). Many people still have no access to health care, and the demand for drugs, which are publically provided, significantly exceeds supply.

Burden of Disease

Communicable diseases remain the highest burden of disease in Mauritania, but non-communicable diseases are increasing rapidly. The top five causes of death are lower respiratory infections, perinatal conditions, diarrheal diseases, malaria, and cerebro-vascular disease.

As of 2004, communicable diseases represented 56.1% of all deaths; non-communicable diseases represented 36.9% and cancer 6.3%.

Reflection work and multidisciplinary analyses are in progress. The Ministry of Health is preparing and elaborating a national action plan to fight against cancer. There is currently no cancer registry in Mauritania, and only four pathology registries exist.

Cancer Control Component

Mauritania has one oncology centre (National Oncology Centre (NOC)) in Nouakchott, established between 2006 and 2008. The centre has ten specialized doctors, three general doctors, three radiotherapists trained in Morocco, ten nurses, two MRI machines (one public and one private), and three pathologists. There are four pathology laboratories (two public and two private). Only the NOC pathology lab is able to perform immunohistochemistry analyses. The volume of pathological examinations remains inadequate in terms of availability and capabilities of the laboratory. A partnership with the sub-region is in discussion. This partnership could lead to optimization of the laboratory capability.

The cancer centre has two bunkers. One of which is equipped with a linear accelerator (Varian). About 1,000 radiotherapy sessions are offered every month.

The centre has 40 beds and offers diagnostic and chemotherapy services. As of the end of 2014, the centre treated about 5,000 patients, and reduced the number of patients sent abroad for chemotherapy and radiotherapy by 90-95%.

On the decision of the State, all the diagnostic and treatments are free of charge to all patients. The centre uses standard chemotherapy protocols with virtually all available molecules. Shortages occur in 1 to 5% of cases for some molecules, and are generally resolved within two-three weeks.

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Mauritania has signed a partnership agreement with the Roche company in a programme called ACCESS, which will grant access of all targeted therapeutic molecules such as herceptin.

Although there is no National Fight Against Cancer programme, this did not prevent the conduct of occasional campaigns during the last 20 years. These involved screening 500,000 women for cervical and breast cancer. These campaigns resulted in reduction of cervical cancer prevalence from 5% in 2000 to 1.8% in 2014 in the district of the capital (1/3 of the Mauritane population).

Table 2: Incidence of cancer by gender and by category (2008)

<table>
<thead>
<tr>
<th>Cancer site</th>
<th>Number of cases</th>
<th>% of cancers</th>
<th>Crude rate ASR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>278</td>
<td>23.9%</td>
<td>20.3</td>
</tr>
<tr>
<td>Prostate</td>
<td>30</td>
<td>2.5%</td>
<td>16.0</td>
</tr>
<tr>
<td>Stomach</td>
<td>55</td>
<td>4.4%</td>
<td>4.6</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>40</td>
<td>6.5%</td>
<td>3.9</td>
</tr>
<tr>
<td>Colorectum</td>
<td>40</td>
<td>3.3%</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Table 3: Mortality of cancer by gender and by category

<table>
<thead>
<tr>
<th>Cancer site</th>
<th>Number of cases</th>
<th>% of cancers</th>
<th>Crude rate ASR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
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<td>20.3</td>
</tr>
<tr>
<td>Prostate</td>
<td>30</td>
<td>2.5%</td>
<td>16.0</td>
</tr>
<tr>
<td>Stomach</td>
<td>55</td>
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<td>4.6</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>40</td>
<td>6.5%</td>
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</tr>
<tr>
<td>Colorectum</td>
<td>40</td>
<td>3.3%</td>
<td>4.4</td>
</tr>
</tbody>
</table>

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The State of Oncology in Africa – 2015

In 2016, the Mauritian population is estimated to lie around 1,278,000 (Including Agalega, Rodrigues and Saint Brandon islands). The cancer incidence in the Republic of Mauritius for the year 2014 represents the new cancer cases registered till December 2014. Data was compiled from multiple sources (Radiotherapy patient register, Laboratory archives, Regional hospitals medical in-patient records and also data from private pathologists) by the cancer registry. 2,387 new cancer cases were registered. The total number of cancer cases among men were 1,068 and 1,319 among women. (Mauritius National Cancer Registry, 2014)

Compared to year 2013, new cases of cancer have increased by 13.0% in men and by 1.4 % in women. This trend is expected to rise and today cancer is the third burden of Mauritian population after diabetes and cardiovascular diseases. The main cancers observed in men are colon, prostate and lung and in women are breast, colon/rectum and cervix (Table 1 & 2). In children the main problem is acute leukæmia. (Mauritius National Cancer Registry, 2014)

### Table 1: Most frequent cancers in men

<table>
<thead>
<tr>
<th>Site</th>
<th>Number</th>
<th>Percentage</th>
<th>ASR(W)/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorectal cancer</td>
<td>318</td>
<td>12.2 %</td>
<td>17.1</td>
</tr>
<tr>
<td>Prostate</td>
<td>322</td>
<td>11.5 %</td>
<td>16.2</td>
</tr>
<tr>
<td>Lung</td>
<td>218</td>
<td>9.6 %</td>
<td>13.5</td>
</tr>
<tr>
<td>Lip and oral cavity, pharynx</td>
<td>67</td>
<td>2.3 %</td>
<td>1.7</td>
</tr>
<tr>
<td>Stomach</td>
<td>45</td>
<td>1.7 %</td>
<td>1.8</td>
</tr>
<tr>
<td>Bladder</td>
<td>40</td>
<td>1.5 %</td>
<td>1.7</td>
</tr>
<tr>
<td>Larynx</td>
<td>33</td>
<td>2.3 %</td>
<td>4.7</td>
</tr>
<tr>
<td>Non Hodgkin Lymphoma</td>
<td>31</td>
<td>2.6 %</td>
<td>4.7</td>
</tr>
<tr>
<td>Dermatologic</td>
<td>34</td>
<td>2.3 %</td>
<td>3.4</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>31</td>
<td>2.6 %</td>
<td>4.7</td>
</tr>
</tbody>
</table>

### Table 4: Prevalence of Tobacco use and exposure

<table>
<thead>
<tr>
<th>Site</th>
<th>Adult men</th>
<th>Adult women</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco use prevalence (%)</td>
<td>22.6</td>
<td>23.1</td>
<td>23.1</td>
<td>23.1</td>
</tr>
<tr>
<td>Youth exposed to second hand smoke (%)</td>
<td>43.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Conclusion

In terms of population and financial means, it is clear that Mauritania could easily cope with the difficulties in the fight against cancer. This would require:

- to quickly set up a real cancer registry (African Cancer Registry Network),
- to increase human resources through the training of local oncologists (currently oncologists are all foreigners) and nurses (including palliative care)
- to sustain the means already in place (drugs, consumables for immunohistochemistry, etc.).

However, while the human means and the skills exist, the political will and force of application of all these means by the government are still lacking.

References


The State of Oncology in Africa – 2015

The upward trend in incidence could prevail as the country is increasing in its socio-economic level. More than 40% increase in new cases was seen from 1992 to 2014, with colon/rectum for men and breast for women as most common sites. (Nabholtz)

Table 2: Most frequent cancers in women

<table>
<thead>
<tr>
<th>Site</th>
<th>Number</th>
<th>Percentage</th>
<th>ASR(W)/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>491</td>
<td>37.2 %</td>
<td>58.2</td>
</tr>
<tr>
<td>Colorectal carcinoma</td>
<td>115</td>
<td>8.7 %</td>
<td>13.5</td>
</tr>
<tr>
<td>Oesophagus</td>
<td>99</td>
<td>7.6 %</td>
<td>9.7</td>
</tr>
<tr>
<td>Pancreas</td>
<td>63</td>
<td>4.8 %</td>
<td>7.2</td>
</tr>
<tr>
<td>Stomach</td>
<td>37</td>
<td>2.8 %</td>
<td>4.4</td>
</tr>
<tr>
<td>Uterus</td>
<td>29</td>
<td>2.2 %</td>
<td>3.0</td>
</tr>
<tr>
<td>Brain, central nervous system</td>
<td>24</td>
<td>1.9 %</td>
<td>4.7</td>
</tr>
<tr>
<td>Thyroid</td>
<td>20</td>
<td>1.5 %</td>
<td>4.3</td>
</tr>
<tr>
<td>EFSR</td>
<td>65</td>
<td>23.9 %</td>
<td>1.4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,319</td>
<td>100 %</td>
<td>19.6</td>
</tr>
</tbody>
</table>

Table 3: Summary statistics of cancer in Mauritius

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
<th>Both sexes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (thousands)</td>
<td>634</td>
<td>684</td>
<td>1,319</td>
</tr>
<tr>
<td>Number of new cancer cases (thousands)</td>
<td>53</td>
<td>51</td>
<td>104</td>
</tr>
<tr>
<td>Age standardized rate (18)</td>
<td>100.9</td>
<td>110.4</td>
<td>105.7</td>
</tr>
<tr>
<td>Risk of getting cancer before age 75 (%)</td>
<td>7.3</td>
<td>12.2</td>
<td>9.8</td>
</tr>
<tr>
<td>Number of cancer deaths (thousands)</td>
<td>53</td>
<td>51</td>
<td>104</td>
</tr>
<tr>
<td>Age standardized rate (18)</td>
<td>100.9</td>
<td>110.4</td>
<td>105.7</td>
</tr>
<tr>
<td>Risk of dying from cancer before age 75 (%)</td>
<td>7.6</td>
<td>6.6</td>
<td>7.9</td>
</tr>
</tbody>
</table>

### Table 6: The most common causes of mortality in 2014 in men

<table>
<thead>
<tr>
<th>Site</th>
<th>Number</th>
<th>%</th>
<th>Crude mortality rate/10^5</th>
<th>ASR/World/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>123</td>
<td>20.0%</td>
<td>11.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Prostate</td>
<td>42</td>
<td>11.3%</td>
<td>11.2</td>
<td>11.8</td>
</tr>
<tr>
<td>Colon-Rectum</td>
<td>73</td>
<td>12.2%</td>
<td>11.2</td>
<td>9.9</td>
</tr>
<tr>
<td>Brain</td>
<td>40</td>
<td>6.3%</td>
<td>8.6</td>
<td>7.4</td>
</tr>
<tr>
<td>Pancreas</td>
<td>47</td>
<td>7.6%</td>
<td>6.6</td>
<td>6.5</td>
</tr>
<tr>
<td>Liver and intra-hepatic bile ducts</td>
<td>75</td>
<td>12.2%</td>
<td>11.7</td>
<td>10.0</td>
</tr>
<tr>
<td>Bladder</td>
<td>16</td>
<td>2.7%</td>
<td>2.6</td>
<td>2.2</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>186</td>
<td>17.4%</td>
<td>16.6</td>
<td>15.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>857</td>
<td>95.0%</td>
<td>95.0</td>
<td>81.5</td>
</tr>
</tbody>
</table>

### Table 7: The most common causes of mortality in 2014 in women

<table>
<thead>
<tr>
<th>Site</th>
<th>Number</th>
<th>%</th>
<th>Crude mortality rate/10^5</th>
<th>ASR/World/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>150</td>
<td>25.9%</td>
<td>26.8</td>
<td>31.3</td>
</tr>
<tr>
<td>Colon-Rectum</td>
<td>82</td>
<td>8.4%</td>
<td>7.7</td>
<td>7.6</td>
</tr>
<tr>
<td>Breast</td>
<td>40</td>
<td>6.4%</td>
<td>5.8</td>
<td>6.4</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>34</td>
<td>6.4%</td>
<td>5.8</td>
<td>5.8</td>
</tr>
<tr>
<td>Brain</td>
<td>16</td>
<td>2.9%</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Pancreas</td>
<td>47</td>
<td>6.3%</td>
<td>6.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Liver and intra-hepatic bile ducts</td>
<td>71</td>
<td>2.8%</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>17</td>
<td>2.9%</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>858</td>
<td>95.0%</td>
<td>95.0</td>
<td>84.5</td>
</tr>
</tbody>
</table>

Mortality observed in 2014 in Mauritius accounts for 1,177 deaths. 597 deaths occurred in men and 580 in women. (Mauritius National Cancer Registry, 2014)

This figure is projected to increase to approximately 1,900 in 2030 (*GLOBOCAN estimate*)

- **Liver**: Liver cancer is the leading cause of death due to cancer in both men and women in Mauritius. In 2014, 123 deaths occurred due to liver cancer, accounting for 20.0% of all cancer deaths in men and 8.4% in women. The crude mortality rate is 11.0/10^5 in men and 7.7/10^5 in women.
- **Prostate**: Prostate cancer is another significant cause of mortality, with 42 deaths in men (11.3% of all cancer deaths) and 6.4% in women. The crude mortality rate is 11.2/10^5 in men and 7.6/10^5 in women.
- **Brain**: Brain cancer is a significant cause of mortality, with 40 deaths in men (6.3% of all cancer deaths) and 6.4% in women. The crude mortality rate is 8.6/10^5 in men and 6.2/10^5 in women.
- **Pancreas**: Pancreatic cancer is another significant cause of mortality, with 47 deaths in men (7.6% of all cancer deaths) and 6.3% in women. The crude mortality rate is 6.6/10^5 in men and 6.2/10^5 in women.

These statistics highlight the need for improved cancer screening and treatment facilities in Mauritius to address these leading causes of cancer mortality.
In developed countries, there is a rapid evolution towards the integration of extremely potent biology-oriented therapies (anti-HER2, tyrosin kinase inhibitors, immunotherapies). It has been shown that advances in standard care and the impact of new biologic drugs have already allowed a significant improvement of cancer survival and quality of life with an accelerating trend. (Nabholtz)

As a consequence, in countries in transition, there is a strong need to anticipate this evolution in order to minimize the foreseeable increasing gap between developed countries and countries in transition.

**Current Status For Cancer Services In Mauritius**

Mauritius has implemented since 2010 a national cancer control program action plan. Several goals at different stages of implementation have been identified by the National Cancer Control Program (NCCP):

1. Reducing exposition to risk factors of cancer
2. Promoting early screening
3. Ensuring timely access to diagnosis and treatment
4. Improving the patient and family experience of cancer care
5. Supporting an efficient Mauritius Cancer Register

In terms of public information, different campaigns through the media are conducted as regards to preventive health measures and adoption of healthier life-styles.

As regards to screening, the government is working on the elaboration of mobile clinics to give access to breast and cervical screening to all Mauritian women. At the level of the Central Health Laboratory free services are provided for testing of circulating tumour markers and Immunohistochemistry markers. Since 1995, a computerised system for all paraffin blocks is available; besides the paraffin blocks have been archived for at least the past two decades.

National screening and early detection programs exist for cervical (Pap smears) and breast cancer, (clinical palpation and diagnostic mammography) together with community-based awareness campaigns.

Medical and surgical management of cancer is undertaken in all 5 public hospitals and all private clinics. Multidisciplinary meetings are held for cases of breast, brain and paediatric tumours. There has been much progress done in the country from imagery through biopsy to laboratory analysis. For radiation therapy, one centre is present at Victoria hospital with technical access to 1 linear accelerator and 2 cobalts.

For systemic cancer treatment, all care including chemotherapy, hormonotherapy are delivered in several sites. In terms of treatment, patients have access to various infrastructures in Public and Private sectors. The Ministry of Health provides free of charge more than 40 different chemotherapy drugs, mainly generic drugs, beyond the recommended WHO essential chemotherapy list of drugs.

For palliative care, it is primarily hospital-based. Pain management has also improved. Access to opiates is possible in oral and parenteral forms but limited to a ten day outpatient repeat prescription by the Dangerous Drug Act. Emergency palliative radiotherapy is also offered. A very efficient cancer registry is allowing a clear vision of cancer Mauritius.

Today, in Mauritius, there is no clinical and translational research. This is an important point for the integration and access to novel major drugs including new biological therapies. Cancer management needs implementation of research in order to optimize patient care. Even if standards of treatment are good in Mauritius, the trend in incidence might be expected to rise.

There is much effort from the public administration and several stakeholders who are committed to reduce this ascending trend of new cancer cases by putting more emphasis on the preventive aspect of cancer control and to provide the best possible care (Mohith et al., 2015)

**References**


The adult literacy rate in Mozambique is 49.9% according to the 2015 National Statistic Institute data. Only 35% of the population has access to safe drinking water. Work force is largely concentrated in the agricultural sector (81%).

**The National Health System**

The National Health System covers approximately 60% of the population and is heavily dominated by the public sector. The private health care providers are mostly concentrated in big cities. Additionally, many National and International non-governmental organizations (NGO) provide preventive and curative care at rural and district level. The Government is revitalizing the community health workers networks, as a mean to improve access to health care.

Non-communicable diseases (NCD) are considered a major public health problem by the Ministry of Health of Mozambique since 2008. Cardiovascular diseases, diabetes, cervical cancer, breast cancer, prostate cancer and trauma are included in priority interventions for the health sector, according the 2014-2019 Health Strategic Plans (Table 1).

Table 1: Organisation of Health Care Network

<table>
<thead>
<tr>
<th>Level</th>
<th>Category of health unit (HU)</th>
<th>Beds</th>
<th>Types of care provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Health centers I and II urban and rural</td>
<td>10,180</td>
<td>Primary prevention and outpatient care</td>
</tr>
<tr>
<td>II</td>
<td>Rural and district hospitals</td>
<td>4,590</td>
<td>First reference, with admission and surgery</td>
</tr>
<tr>
<td>III</td>
<td>Provincial hospitals</td>
<td>2,202</td>
<td>Surgery, obstetrics, gynaecology, pediatrics, internal medicine, orthopaedics and dentistry</td>
</tr>
<tr>
<td>IV</td>
<td>Central Hospital and psychiatric hospitals</td>
<td>3,842</td>
<td>Multiple specialties and some subspecialties; most advanced HU</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20,014</td>
<td></td>
</tr>
</tbody>
</table>

Mozambique is located on the coast of Southern Africa with a total area of 799,380 km$^2$. The country as a long coastline of 2,515 km and is divided into 11 provinces and 152 Districts. According the National Statistic Institute, the 2015 total population is 26.423 million, based on projections from the 2007 census. There is a slight preponderance of women and the urban population represents 32% of the total population. The population is relatively young, with 40% being below 15 years of age and 16.6% under 5 years. The population annual growth rate is 2.7% (Figure 1).

![Mozambique: Population](image)

**Figure 1:** Population Pyramid by Age Group and Gender, 2015 (National Statistics Institute, 2015)
Cancer Registration and Overview of Cancer

A population-based cancer registry in Mozambique was started in early 1960s by Prates and Torres and stopped in 1965, shortly after the start of the Mozambican war of independence. This registry was placed at Miguel Bombarda Hospital (presently the Maputo Central Hospital) and covered an area of 60 km². During this period the burden of cancer was dominated by liver cancer, in both genders (Table 2).

Table 2: Cancer Incidence/100,000 hab

<table>
<thead>
<tr>
<th>Site</th>
<th>Cases (all ages)</th>
<th>%</th>
<th>Age-adjusted incidence rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>264</td>
<td>65.5</td>
<td>101.7</td>
</tr>
<tr>
<td>Bladder</td>
<td>24</td>
<td>6.0</td>
<td>51.3</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>18</td>
<td>4.3</td>
<td>57.1</td>
</tr>
<tr>
<td>Non-melanoma skin</td>
<td>13</td>
<td>3.2</td>
<td>2.6</td>
</tr>
<tr>
<td>Breast</td>
<td>94</td>
<td>23</td>
<td>65.5</td>
</tr>
<tr>
<td>All sites</td>
<td>403</td>
<td>100</td>
<td>184</td>
</tr>
</tbody>
</table>

In 2006, Ferro implemented a pilot project of population-based cancer registry in Beira city which was unfortunately stopped in 2007 (African Cancer Registry Network, 2016). The data presented a strong burden of AIDS-related cancers dominated by Kaposi’s Sarcoma (Figure 2).
In 2014, the registry system was updated and modernized; in 2015 a population-based registry was started in Maputo City. Data analysed from January to October 2014, presents a total of 759 cases (62% in women). Prostatic cancer and Kaposi’s Sarcoma were the leading cancer sites in men (Figure 4), cervical cancer in women (Figure 5) and lymphoma in children (Figure 6). Liver cancer is also predominant in men (12% of cases in adult men).
Cancer Centres

There are two cancer treatment centres in Mozambique, at Maputo Central Hospital. In addition to these, there are chemotherapy units at the Nampula Central Hospital. The role of private units in cancer management is very limited. The only radiotherapy centre is being refurbished in order to fulfill international requirements. The planned equipment includes a linear accelerator, a high-dose brachytherapy unit and an appropriate simulator room. There is currently no radiotherapy treatment provided in Mozambique. All patients requiring such treatment have to go to South Africa or India, either at their own expense or with the financial support of the government.

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The National Cancer Control and Prevention Programme (NCCP)

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Unfortunately, many cancers are diagnosed in advanced stage, due to a lack of information and weak detection capacities of the health system. A community programme including pain management, nutritional and psychological support was organized in collaboration with a NGO in order to deal with patients requiring palliative care.

Mozambique adopted the International Framework Convention for Tobacco control. Both legal measures and educational programmes are in place for strongly controlling tobacco consumption. Advertising tobacco use and smoking in closed environments are forbidden by law. However, strong tobacco lobbies are playing an important role and try to avoid the implementation of more aggressive legal measures.

Mozambique created a strong programme against abusive alcohol consumption. Selling alcohol to people less than 18 years is illegal. Additional legal measures were adopted to control the public selling of alcohol. However, the implementation of those measures is very weak, due to several factors, including the weak auditing system, commercial interests and lobbies.

Infectious risk factors which promote cancer (HIV, HPV, Hepatitis B and C, EBV, Helicobacter Pylon and Schistosomiasis) are monitored. Promotion of interventions such as safe sex, eradication of the schistosoma parasite and hepatitis B vaccination are part of measures being taken to reduce these risk factors.

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Cervical cancer screening using visual inspection with acetic acid (VIA) is the most disseminated programme in cancer control in Mozambique. It is done in all districts at primary health care centres by trained nurses. Cryotherapy is done in all central and provincial hospitals and in some district hospitals. Pap smears are available in all three central hospitals.

Prevention and Early Detection

Like in most African countries, the increasing incidence of cancer in Mozambique was linked with several risk factors, including infectious agents and lifestyle-related factors such as tobacco, alcohol, unhealthy diet and physical inactivity. A study was carried out to identify risk factors associated with liver cancer, whose burden is particularly high in Mozambique. Food contamination with aflatoxin was identified as the leading cause (Prates et al, 1965). An appropriate preventive programme was set up, not only for early detection through screening, but also with strong public education and information as well as legal measures.

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Chapter 16

Nigeria

Olufemi J. Ogunbiyi, Olaitan Soyannwo, Akin Tunde-Odukogbe

Nigeria is a Western African country with a total area of 356,667 square miles (923,768 km²). Nigeria has a rich ethnic diversity, with more than 250 ethnic groups, including Hausa and Fulani (29%), Yoruba (21%), Igbo (18%), Ijaw (10%), Kanuri (4%), Ibibio (3.5%) and Tiv (2.5%).

The most widely professed religions are Islam (50%) and Christianity (40%), with a minority of indigenous beliefs (10%).

The literate rate is approximately 59.6%, with a rate of 69.2% and 49.7% in men and women, respectively (2015 estimate).

The total and per capita gross domestic product were estimated at $478.5 billion and $2,800 in 2013, respectively. Nigeria has a high growth rate (6.2%), inflation (8.7%) and unemployment (23.9%). Arable land represents 39.0% of the country area.

Regarding agriculture and farming, the main resources are cocoa, peanuts, palm oil, corn, rice, sorghum, millet, cassava (tapioca), yams, rubber, cattle, sheep, goats, pigs, timber and fish.

The labour force represents 51.53 million people. Based on 1999 estimates, people mainly work in the agricultural sector (70%) followed by services (20%) and industry (10%).

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The labour force represents 51.53 million people. Based on 1999 estimates, people mainly work in the agricultural sector (70%) followed by services (20%) and industry (10%).

The main industries include crude oil, coal, tin, columbine, palm oil, peanuts, cotton, rubber, wood, hides/skins, textiles, cement and other construction materials, food products, footwear, chemicals, fertilizers, printing, ceramics, steel, small commercial ship construction and repair. The natural resources are natural gas, petroleum, tin, columbine, iron, coal, limestone, lead, zinc and arable lands.

The population was estimated in 2014 at 177,155,754 with a growth rate of 2.47%, a birth rate of 38.03 per 1,000, and an infant mortality rate of 74.09 per 1,000.

The population is relatively young with a majority under 25 years-old (62.39%; 2015 estimates).

The State of Oncology in Africa - 2015

Drugs

Mozambique adopted a National Drug List (including oncology drugs) since the early 1970th, which is revised regularly. The availability of drugs for cancer control is warranted by a central medicine storage directorate which is responsible for acquiring drugs for the public health system. Oncologists and oncology-related medical personnel are involved in the definition of the drug list and prioritization of the necessary items. Of note, the Maputo central hospital has the autonomy to acquire small amounts of drugs for selected and justified clinical cases.

References


Carrilho C. Implementing Cancer Registry Program 2014.

In 2015, the male/female ratio in the total population was slightly higher than 1.04, and remained consistently above one, except for older age categories. The male/female ratio is 1.06 at birth, 1.05 for ages 0-5 years, 0.95 for 5-64 years and 0.91 for over 65 years of age. As of 2015, life expectancy is 53.02 years for the total population (52 for men and 54.1 for women, respectively).

The health expenditure was about 4% of GDP as of 2013 and the adult HIV prevalence rate was approximately 3.17% in 2014.

In 2015, 68.5% of the total population had access to drinkable water, and 31.5% had not. The improvement of access to water was mainly observed in urban areas, where 80.8% of the population had access to drinkable water, vs. 57.3% in rural areas.

The most reliable data on cancer incidence in Nigeria derive from the three working population-based registries in Ibadan, Abuja, and Calabar. A report on the data from especially Ibadan (IBCR) and Abuja (ABC) was published in 2012 in the journal Cancer Epidemiology (Jedy-Agba et al, 2012a; Jedy-Agba et al, 2012b). The PBCRs reported on the age-standardized incidence rates (ASR) of the most common cancers in Nigeria (Jedy-Agba et al, 2012a). In women, the most common cancers were breast (54.3/100,000) and cervix (34.5/100,000). In men, the most frequent cancer was prostate (19.1/100,000). Information on the number of cases by site and gender, most valid basis of diagnosis as reported by 11 hospital-based cancer registries in Nigeria has also been published (Jedy-Agba et al, 2012b).

Table 1: Most common cancers and age standardized rates in Nigeria in 2012

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<tbody>
<tr>
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</tr>
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Figure 2: Population Pyramid by Age Group and Gender

About 47.8% of the population lives in urban communities and the urban migration rate is about 4.6% annually. The largest cities in Nigeria (2011 estimates) are Lagos (11.223 million); Kano (3.375 million); Ibadan (2.949 million); Abuja (2.153 million); Port Harcourt (1.894 million) and Kaduna (1.524 million).

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The age standardized incidence rate for all invasive cancers from the IBCR was 66.4 per 100,000 men and 138.6 per 100,000 women. In ABCR it was 58.3 per 100,000 for men and 138.6 per 100,000 for women. A total of 3,393 cancer cases were reported by the IBCR. Of these cases, 34% (1,155) were seen among men and 66% (2,238) in women. In Abuja over the same period, 1,128 invasive cancers were reported. 33.6% (389) of these cases were in men and 66.4% (768) in women. Mean age of diagnosis of all cancers in men for Ibadan and Abuja were 51.1 and 49.9 years respectively. Breast and cervical cancer were the commonest cancers among women and prostate cancer the most common among men. Breast cancer age standardized incidence rate (ASR) at the IBCR was 52.0 per 100,000 in IBCR and 64.6 per 100,000 in ABCR. Cervical cancer ASR at the IBCR was 60.0 per 100,000 and 30.3 per 100,000 at the ABCR. The observed differences in incidence rates of breast, cervical and prostate cancer between Ibadan and Abuja, were not statistically significant.
Chapter 16n

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**Nigeria**

### Nigeria: Age-Specific Rates for all Cancers

![Figure 3: ASR for Cancers in Nigeria](image)

Childhood cancers (age 0-14) represented 3.6% of all the cancers recorded in 2013. A total of 236 childhood cancers were registered. They occurred in 123 (52.1%) boys and 113 (47.9%) girls. The five most frequent cancers (n (%)) in boys classified according to the ICCC system were lymphoma 21 (17.0%), soft tissue sarcomas 20 (16.3%), leukaemia 17 (13.8%), retinoblastoma 15 (12.2%) and renal tumours 13 (10.6%). In women, the five most frequent were renal tumours 22 (19.5%), soft tissue sarcomas 16 (14.2%), lymphoma 13 (11.5%), retinoblastoma 12 (10.6%) and leukaemia 11 (9.7%). Kaposi’s Sarcoma accounted for 41.7% of the soft tissue sarcomas in both boys and girls.

### Cancer Mortality

In terms of percentages, cancer mortality in Nigeria is very close to the incidence. There is no national screening programme for cancer and the majority of cancers are diagnosed at late stage regardless of them being preventable or not.

Data on survival is scanty because of challenges experienced with the follow-up of cancer patients (including the inadequacies of death registration in the country) but there is a renewed drive to ensure this information is captured.

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**Table 2. Most Frequent Invasive Cancers < 45 years**

<table>
<thead>
<tr>
<th></th>
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<th>Abuja</th>
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</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Liver (1)</td>
<td>40 (4.5)</td>
<td></td>
</tr>
<tr>
<td>2. NMSC (1)</td>
<td>21 (2.5)</td>
<td></td>
</tr>
<tr>
<td>3. NHL (1)</td>
<td>17 (2.0)</td>
<td></td>
</tr>
<tr>
<td>4. Connective &amp; soft tissue (1)</td>
<td>12 (1.5)</td>
<td></td>
</tr>
<tr>
<td>5. Nasopharynx (1)</td>
<td>10 (1.2)</td>
<td></td>
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<table>
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<tr>
<th></th>
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<td></td>
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<tr>
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<td>5. Kaposi’s Sarcoma (1)</td>
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</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Prostate (1)</td>
<td>30 (3.5)</td>
<td></td>
</tr>
<tr>
<td>2. Colorectal (1)</td>
<td>12 (1.4)</td>
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</tr>
<tr>
<td>3. NMSC (1)</td>
<td>47 (5.5)</td>
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</tr>
<tr>
<td>4. Liver (1)</td>
<td>40 (4.7)</td>
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</tr>
<tr>
<td>5. Larynx (1)</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Ibadan</th>
<th>Abuja</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Breast (1)</td>
<td>527 (63.2)</td>
<td></td>
</tr>
<tr>
<td>2. Cervix (1)</td>
<td>430 (51.2)</td>
<td></td>
</tr>
<tr>
<td>3. Colorectal (1)</td>
<td>47 (3.4)</td>
<td></td>
</tr>
<tr>
<td>4. Liver (1)</td>
<td>12 (1.4)</td>
<td></td>
</tr>
<tr>
<td>5. Corpus uteri (1)</td>
<td>36 (4.5)</td>
<td></td>
</tr>
</tbody>
</table>

Number of cases and proportions (n%) of the 5 most frequent cancers in each registry by sex, stratified by age group. (NMSC: Non Melanoma skin cancer; NHL: non-Hodgkin’s lymphoma)

There was a steady rise in age-specific incidence rate of all invasive cancers from age 0–4 years to 65 years and greater in men in both registries. Among women, the age-specific incidence rate for all invasive cancers peaked at 55–64 years in both registries.
Medical Oncology Resources

In Nigeria, cancer therapy is provided by surgical oncologists and radiation oncologists. There are no trained medical oncologists working in Nigeria. There are however haematologists who administer chemotherapy for haematologic malignancies. In addition, there are paediatric oncologists in some centres.

There is limited availability of chemotherapy drugs in the public sector. Most patients acquire drugs at their own expenses. The cost of these medicines is prohibitive for the vast majority of the population. Even in the private sector, there are shortages of chemotherapy drugs. These factors commonly lead to disruptions and delays in the treatment of patients and may possibly result in poor treatment outcomes.

Radiotherapy Resources

The use of low dose, manual after loading Caesium brachytherapy was introduced for treating gynaecological malignancies in the 1960s at the University College Hospital Ibadan. About the same time or very shortly after it, the Lagos University Teaching Hospital introduced the use of ionizing radiation for the treatment of superficial tumours with ortho-therapy. The Lagos University Teaching Hospital (LUTH) commenced frank radiotherapy with a cobalt-60 machine. In 1987 the University College Hospital Ibadan also acquired a cobalt-60 machine. Since then, seven other centres have been established.

There are a total of 50 qualified radiation oncologists in Nigeria, and many others are currently in training.

The present radiotherapy resources in Nigeria are thus:

1. Four Linear accelerators (only two are presently functional)
2. Three TeleCobolt-60 megavoltage (only two are presently functional)
3. Five Linear accelerators (only two are presently functional)
4. Two low-dose rate (LDR) after loading Caesium-brachytherapy machines (none presently functional)
5. One high-dose rate (HDR) Cobalt machine (presently non-functional)
6. One high-dose rate Iridium machine (presently non-functional)

There are nine radiotherapy centres in Nigeria (Lagos University Teaching Hospital, University College Hospital Ibadan, University of Benin Teaching Hospital, University of Nigeria Teaching Hospital, Enugu, Usman Danfodiyo University Teaching Hospital, Sokoto, National Hospital Abuja, Ahmadu Bello University Teaching Hospital, Zaria, Gombe Teaching Hospital and Eko hospital (in private centres).

In each centre, there is a dedicated simulator, 2D planning system. Appropriate dosimetry and quality control equipment for external beam radiation therapy (EBRT) and HDR brachytherapy are available in all centres. Other related equipment are the brachytherapy TPS for each unit, and dedicated C-arm.

Drugs

There is no control on the acquisition and use of chemotherapeutic drugs in Nigeria. Practitioners prescribe by preference and based on pharmaceutical representatives or drug importations of patients themselves. Some drugs are sometimes available free of charge from donors through research endeavours or donations from philanthropists.

The State of Oncology in Africa – 2015

The National Cancer Control and Prevention Programme (NCCP)

In recognition of cancer being a major cause of morbidity and mortality, the Nigerian Federal Ministry of health established a National Cancer Control Programme with a Cancer Plan for 2013-2018. The purpose of that five-year plan was to: draw attention of all stakeholders and to bring to the fore the types of cancer in our environment and the interventions required to reverse the alarming trend.

The plan included ten goals designed to focus attention on the priority areas, strategies and activities to address the challenges:

1. Increase Cancer information dissemination, education, and cancer outreach services nationwide.
2. Increase opportunities for cancer training for relevant healthcare providers and advocates.
3. Improve the clinical services for cancer prevention, early detection, diagnosis, and treatment.
4. Improve the documentation of the location and quality of existing cancer facilities, manpower and services.
5. Develop and establish policies and regulations for quality cancer care and services.
6. Increase funding for research activities in cancer control.
7. Create a systematic framework for the dissemination of national and international cancer research.
8. Improve the cancer surveillance system to delineate public health priorities as well as plan and monitor comprehensive strategies for cancer control.
9. Facilitate effective communication and collaboration among public and private cancer stakeholders nationwide.
10. Ensure quality palliative care services including pain control.

The document was crafted through extensive consultative processes involving national and international stakeholders and was coordinated by the National Cancer Control Strategy Committee.

Following this plan, an increasing activity in the field was observed with pockets of screening programmes based on NGO activities or church-related activities. However, there is still no national screening programme for any cancer in place.

Breast Cancer

Mammography is available in a few teaching hospitals and a couple of private diagnostic services in about five major urban cities. The current available mammography capacity is far below what would be needed for national coverage of women at risk. There is a gradual increase in the prevalence of clinical breast exams due to the activities of NGOs especially rooting for the prevention and early detection of breast cancer. Many of these accesses are funded from international bodies including the NCI and other philanthropic organisations from abroad. Still, the number of people getting breast examinations is very low.

Awareness of the importance of breast self-examination still needs to be prioritized together with instruction on the technique of how to perform such self-examinations.

Cervical cancer

Cervical cancer still forms over 60% of cases of gynaecological cancers in Nigeria. There is no established population-based screening system for its prevention. Opportunistic screening occurs in some public and private hospitals/clinics and recently in some religious centres. Many NGOs...
are attempting to raise awareness levels about the disease, its prevention through lifestyle alterations, the newly introduced vaccines and the measures to detect early and treat its pre-invasive lesions.

Because of its high cost and the need for highly trained histo-pathologists, the more specific Pap smear test is available in few centres in urban areas. Human papilloma virus (HPV) testing and colposcopy are even less available. The less specific although more sensitive visual inspection methods which use acetic acid and/or Lugol’s iodine are having wide publicity and advocacy especially because of the benefits of single visit, “see and treat” approach using cryotherapy when abnormalities are seen, and the low cost.

Although awareness appears to be increasing gradually, severe limitations of our health care system still make utilisation of even the low-cost visual inspection services to be grossly suboptimal.

Other Cancers

Only ad hoc screening measures are available for all other cancers. For prostate cancer digital rectal examination (DRE) is not routinely offered by the majority of health workers and most public hospitals do not offer PSA screening, although the latter is sometimes offered at awareness events throughout the country.

The situation is similar for other cancers such as colon cancer. There is recognition of the prohibitive costs of screening services, absence of an effective national mechanism to motivate, organize and coordinate cancer screening activities and a sound referral system of referral centres with capacity to take up the cases as they are identified.

Palliative Care

Palliative care was first introduced in Lagos, Nigeria in 1991. By 1993, Hospice Nigeria was registered and major advocacy efforts included support from visiting Dr. Anne Merriman, founder of Hospice Africa, Uganda. The current movement commenced in 1996 when a team of health professionals in Ibadan led by Prof. Olaitan Soyannwo formed the Cancer Pain Group. Its goal was to address the pain and suffering experienced by cancer patients and the unavailability of strong opioid analgesics. This movement resulted in the establishment of holistic palliative care service in many parts of the country.

This led to the inauguration of Society for the Study of Pain (SSPN) in 1998 as a chapter of the International Society for the Study of Pain (IASP), and Palliative Care Initiative Nigeria, which was later registered as a Non-governmental organization Centre for Palliative Care, Nigeria (CPCN) in 2005 (Wright et al, 2006). The Federal Ministry of Health includes palliative care as one of the goals of the National Cancer Plan.

Centre for Palliative Care Nigeria (CPCN) has facilitated training of pioneer palliative care initiators and in-country educational workshops with the support from international agencies especially Hospice Africa United Kingdom, Hospice Africa Uganda, Help the Hospices United Kingdom and African Palliative Care Association. The Federal Ministry of Health, University College Hospital (UCH) and University of Ibadan also funded staff development.

In 2007, in collaboration with CPCN, UCH established the first palliative care unit in a teaching hospital in Nigeria. This unit provides holistic palliative care for patients in the hospital, on day care and home-based care basis; and also offers Clinical placement for training of students and staff from other institutions within and outside Nigeria. Functional palliative care units/teams have subsequently been established in other tertiary and secondary health institutions including the teaching hospitals in Zaria, Enugu, Ilorin, Port Harcourt, as well as the Federal Medical Centre (Abakaliki), the National Hospital (Abuja), Ladoke Akintola University teaching hospital, LAUTECH Osogbo, and recently the General Hospitals in Umuahia and Makurdi (figure 4). All these hospitals provide palliative care service and training. Pain and palliative care issues are also being incorporated into undergraduate and postgraduate curriculae (Oliver et al, 2011).

Palliative care services are largely based in urban and large hospitals (in-patient and day care clinics), but the home-based care and referral systems reach some of those in neighbouring communities (Omoyseni et al, 2014).

Figure 4: Sites of functional palliative care teams

The palliative service in Nigeria caters for both adult and paediatric patients, mostly those with late stages of cancer as well as patients with other life-limiting illnesses including HIV/AIDS, Sickle cell disease, neurological diseases, late stage organ failures and the elderly. There is no stand-alone hospice in the country but doctors, nurses, pharmacists and social workers drawn from 29 of the 36 States have been trained (mostly in Nigerian hospitals) to provide palliative care services.
Training of cancer data abstractors takes place as institutions become interested. There is no national programme for the employment, training and coordination of activities of cancer data abstractors. The offices of vital statistics are also mostly unreliable sources for information on cancer and opioid availability issues. This project aimed to empower trained pharmacists in designated Federal Government tertiary hospitals in the six geo-political zones, to access morphine powder from the central medical stores in Lagos and to prepare oral morphine solution for palliative care patients at cheaper cost.

Opioid availability has been erratic in Nigeria since the late 1990s. South Africa consumed 71% of the opioids in the Africa region (International Narcotics Control Board, 2011) with only 205 kg of opioids consumed per year by the remaining countries. This was enough to treat only about 2.8% of the estimated 1.17 million annual painful deaths from cancer or HIV/AIDS. The average annual morphine-equivalent opioid analgesic consumption in Nigeria from 2007 to 2009 was 1.3 kg (International Narcotics Control Board, 2011).

The Ministry is also moving to establish the manufacture of oral morphine at the Federal Pharmaceutical Manufacturing Laboratory at Yaba, Lagos—a manufacturing facility owned by the Federal government. Vaccination and Cancer in Nigeria

Hepatitis B virus (HBV) vaccination was incorporated into an extending programme of immunization, but the coverage is still extremely low. The Federal Government funds the vaccination of individuals at risk in the health sector. However the uptake is low and the vaccine is not always available. In many other situations, people have to pay for these vaccines, which are not particularly cheap.

The Federal Ministry of Health is the only legal source for controlled drugs for both public and private health facilities in Nigeria. Along with the National Agency for Food and Drug Administration and Control, it established in 2010 a standing committee on the availability of opioid analgesics. By early 2012, the Ministry, in collaboration with the Global Access to Pain Relief Initiative, initiated an emergency procurement of opioid analgesics as a means of improving access to drugs for pain. A full-time staff member was employed within the Ministry to focus on pain relief and opioid availability issues. This project aimed to empower trained pharmacists in designated Federal Government tertiary hospitals in the six geo-political zones, to access morphine powder from the central medical stores in Lagos and to prepare oral morphine solution for palliative care patients at cheaper cost.

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There is a more recent talk on the introduction of the Human Papilloma Virus (HPV) vaccine in schools, but again this is slow in taking off.

Education of Cancer Care Professionals (Human Resource Development)

Training of cancer data abstractors takes place as institutions become interested. There is no national programme for the employment, training and coordination of activities of cancer data abstractors. The offices of vital statistics are also mostly unreliable sources for information on cancer deaths within communities.

Training of radiation oncologists, radiographers and recently medical physicists and oncology nurses is available in Nigeria and as stated earlier on. There are a total of 50 qualified Radiation Oncologists and many others in training.


References

The Cancer Community

There is an increasing number of local voluntary organizations that are involved in cancer efforts in Nigeria. Most are related to breast cancer, but there is also one the interested in skin cancers because of the high prevalence of Albinism in some parts of the country.

Apart from the one in Ibadan, a few hospices are also now developing in different parts of the country albeit with limited facilities and means.

Conclusion

Palliative care, being a new concept in Nigeria is developing at a steady pace. As government interest and support increases, the population will be more adequately informed about the role and benefits of palliative care. It is also essential that palliative care is incorporated into the national health system to extend service and ensure improved quality of life for those with life-limiting illnesses in both urban and rural areas of the country.

Hospice Africa Uganda (Uganda and Nigeria). Almost 100 have attended the five-weeks palliative care initiators course of Hospice Africa Uganda. A few of them further obtained postgraduate qualifications such as Diploma, BSc, MSc and MPH in Palliative Medicine. All the centres are also currently involved in educating both professionals and non-professional health care providers for the country. The UCH palliative care unit has become a recognized service model for clinical placement of undergraduates, post-graduates and continuing education students including students from The Gambia (sponsored by APCA), Sierra Leone, Canada and Sweden. The Badan centre also serves as an external examination centre for the Makerere University BSc and Diploma Palliative care courses.

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Senegal

Senegal is a low income country of west Africa, with a population of 14 million. A bit more than half of the population lives in rural areas (58%). Despite this, most health care resources are concentrated in big urban areas specially in the capital city. Life expectancy at birth was measured to be 59 in 2006. The literacy rate is around 40%. The country is divided into 14 regions. Peanut production accounts for around 40% of cultivated land, taking up to two million hectares, and provide employment for as many as one million people. Peanut oil is processed industrially mainly for exportation and locally for direct regular consumption.

Healthcare is not free for its citizens, meaning that less than 20% of the population can afford some form of coverage. Cancer patients are required to pay for oncology treatment. The healthcare system is generally weak and fragmented with three parallel systems (public, military and private sectors) and state expenditure on health per capita is around 5% of the GDP.

In this context of low resource settings it seems to commend improvisation due to the distance from the knowledge generation centre and the inadequacy between the recommended strategies and the available resources. Intrinsic obstacles, lack of reliable data and human resources, poor quality and lack of standardized medical records, deficient registration of the causes of death (most deaths occurring at home), and poor administrative and financial management of health care facilities, constitute major drawbacks to the development of Senegalese NCCP.

Chapter 16o

Senegal

Mamadou Y. Diop


Chapter 16o

Senegal

Mamadou Y. Diop


Table 1: Cancer incidence in Senegal, GLOBOCAN 2008, Total: 6,646

<table>
<thead>
<tr>
<th>Cancer site</th>
<th>Number of cases</th>
<th>% of cancers</th>
<th>ASR(W)</th>
<th>Cancer site</th>
<th>Number of cases</th>
<th>% of cancers</th>
<th>ASR(W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>151</td>
<td>27.8%</td>
<td>23</td>
<td>Cancer site</td>
<td>1,102</td>
<td>29.3%</td>
<td>14.7</td>
</tr>
<tr>
<td>Breast</td>
<td>115</td>
<td>19.0%</td>
<td>18.5</td>
<td>Breast</td>
<td>853</td>
<td>20.9%</td>
<td>23.0</td>
</tr>
<tr>
<td>Cervix</td>
<td>175</td>
<td>22.9%</td>
<td>6.6</td>
<td>Liver</td>
<td>318</td>
<td>8.8%</td>
<td>18.5</td>
</tr>
<tr>
<td>Neck-Hodgkin lymphoma</td>
<td>180</td>
<td>6.9%</td>
<td>4.2</td>
<td>Stomach</td>
<td>192</td>
<td>4.7%</td>
<td>4.8</td>
</tr>
<tr>
<td>Colon-rectum</td>
<td>127</td>
<td>6.6%</td>
<td>4.2</td>
<td>Colorectum</td>
<td>187</td>
<td>3.6%</td>
<td>4.4</td>
</tr>
<tr>
<td>Total</td>
<td>2,306</td>
<td>100.0%</td>
<td>88.4</td>
<td>Total</td>
<td>4,080</td>
<td>100.0%</td>
<td>18.8</td>
</tr>
</tbody>
</table>

Table 2: Cancer mortality in Senegal, GLOBOCAN 2008, Total: 5100

<table>
<thead>
<tr>
<th>Cancer site</th>
<th>Number of cases</th>
<th>% of cancers</th>
<th>ASR(W)</th>
<th>Cancer site</th>
<th>Number of cases</th>
<th>% of cancers</th>
<th>ASR(W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>837</td>
<td>15.5%</td>
<td>23.1</td>
<td>Cancer site</td>
<td>792</td>
<td>27.9%</td>
<td>14.7</td>
</tr>
<tr>
<td>Breast</td>
<td>436</td>
<td>12.9%</td>
<td>15.5</td>
<td>Breast</td>
<td>477</td>
<td>16.9%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Cervix</td>
<td>316</td>
<td>4.9%</td>
<td>6.4</td>
<td>Liver</td>
<td>318</td>
<td>17.6%</td>
<td>5.5</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>142</td>
<td>2.2%</td>
<td>3.2</td>
<td>Stomach</td>
<td>158</td>
<td>5.5%</td>
<td>5.5</td>
</tr>
<tr>
<td>Colon-rectum</td>
<td>338</td>
<td>6.6%</td>
<td>3.5</td>
<td>Colorectum</td>
<td>113</td>
<td>6.0%</td>
<td>3.7</td>
</tr>
<tr>
<td>Total</td>
<td>2,218</td>
<td>100.0%</td>
<td>88.4</td>
<td>Total</td>
<td>2,286</td>
<td>100.0%</td>
<td>18.8</td>
</tr>
</tbody>
</table>

According to figures from GLOBOCAN 2008 (Publication of the International Agency for Research on Cancer - IARC), the estimated ASR(W) cancer incidence (World Age-Standardized rate) in men is 88.4/100,000 (2,566 new cancer cases), and for women 177.1/100,000 (4,080 new cancer cases). Leading cancers in men are liver (27.8%), prostate (14.0%), stomach (6.8%), non-Hodgkin lymphoma (6.6%), and colorectal cancers (4.9%). In women, cancers of the cervix (29.3%), breast (20.9%), liver (8.3%), stomach (4.1%) and colorectal cancers (4.4%) are the most common. The ASR(W) cancer mortality (world age-standardized rate) according GLOBOCAN is 80.9/100,000 (2,258 death) for men and 90.2/100,000 (2,896 death) for women. Cervical cancer is the leading cause of cancer mortality in the country. Local experts maintain that these figures do not accurately reflect reality and incidence and mortality rates are in fact underestimated (Tables 15.1.1 and 15.1.2).

Cancer Control Programme

The strategic plan is not supported by adequate budgetary resources, around 100,000 US dollars per year. However, it appears that the MoH recognizes the importance of integrating cancer into NCDs and the prevention and control of NCDs are included in the 2009-2018 National Health and Social Development Plan. There is even an NCD focal point (a public health specialist) established at the MoH.
Lack of human resources is one our biggest issues, they need to be upgraded and spread out. Besides, surgical organ specialists, the 4 surgical oncologists, two radiotherapy oncologists, one medical oncologist work in the single Dakar Cancer Centre at Aristide Le Dantec hospital. All eight pathologists, public and private, are located in the capital city.

The scarce cancer diagnosis and treatment services are mainly concentrated in Dakar too. The majority of patients (around 70 %) are present with very late stage disease. However, in practice, the main focus is on treatment oriented approaches that are not linked to early detection and palliative care programmes.

Primary health care centres do not provide cancer prevention, early detection or palliative care services.

Because of late presentation, chemotherapy is frequently used as first or only treatment but the cost is entirely the responsibility of patients. In Senegal, less than 20 % of population have health insurance or can access to the government Medicare programme. However, after years of advocacy, the government has committed to put in next budgetary plan, $2 million subsidy to make chemotherapy accessible.

<table>
<thead>
<tr>
<th>Chemistry</th>
<th>200,000 F CFA - 1,500,000 F CFA</th>
<th>$ 400 - 3,000</th>
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<tbody>
<tr>
<td>Chemotherapy</td>
<td>700,000 F CFA</td>
<td>$ 100</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>100,000 F CFA</td>
<td>$ 0.00</td>
</tr>
<tr>
<td>Total</td>
<td>800,000 F CFA</td>
<td>$ 1,000</td>
</tr>
</tbody>
</table>

### Partnership Policies

Senegal has developed strong partnership policies to strengthen the cancer control action plan.

**INCA France**: A cooperation agreement has been set up in 2011 for three years including:
- Contribution of French experts to elaborate a new NCCP
- Short term practical training in French cancer centres for oncology specialists and nurses
- Specific training courses like colposcopy and cervical precancerous lesions management for gynaecologists
- Study of HPV prevalence in Senegalese women

NCI United States: With the assistance of NCI, we have set up a national cervical cancer screening programme based on HPV rapid testing developed by QIAGEN and proposed as a donation programme. Senegalese MOH has already committed to this method in order to start with a pilot project in the health district of Thies, 70 km from the capital city.

International Atomic Energy Agency: many kind of useful support at different levels have been provided for many years:
- Specific training for radiotherapy oncologists and physicists
- Radiation control and diagnosis devices like the single-gamma camera of the country
- Impact mission in 2010 which purpose was to collect all information needed in order to supprt more appropriatly Senegalese NCCP

World Health Organization: WHO has specially contributed in tumour registry elaboration by achieving a workshop in 2009, giving softwares Cancer Reg four and ICD-O books but because of lack of political willingness to implement the programme, we have been working to set up an online registration method.

### Primary Prevention

Prevalence of tobacco use is intermediate, about 24 % compared to other African countries but it is increasing among women and adolescents.

Senegal has signed the WHO Framework Convention and the law has been enacted but there is no implementation so far.

Vaccination against hepatitis B has been included in Expanded Vaccination Program for free since 2001 but measures need to be taken to prevent cereal aflatoxin contamination especially in rural areas.

Vaccines against HPV are available in drugstores but they are too expensive, their prescriptions are so far individually based but Senegal is applying to the GAVI programme in order to include these vaccines in cervical cancer prevention programme.

### Early Detection

Senegal does not yet have systematic, well-established early detection programmes. The present early detection activities are not well organized or well-coordinated. There is some opportunistic early detection of cervical and breast cancer. Early detection for cervical and breast cancer are prioritized in the former strategic plan 2007-2011. Local NGOs raise awareness of the need for cancer early detection but there has not been much coordination with the clinical services required for patients with suspected cancer.

There is also a project with NCI-USA on cervical cancer screening using low-cost HPV testing that has to be implemented in Thies district area. This programme is based on age patterns of cervical cancer natural history, low cost and rapid testing which accuracy and effectiveness have been proven by randomized clinical trials in rural India and China.

Premenopausal women aged 35 and older will be tested followed by immediate cryotherapy to treat HPV positive women. Before cryotherapy, visual inspection using acetic acid (VA) should assess eligibility for cryotherapy. However, because of recent information from our partners of NCI-USA that QIagen donation programme has been suspended, Senegal will probably start VIA followed by cryotherapy in a single visit programme.

Regarding breast cancer which is the 3rd most common cancer, NGOs like LISCA (Ligue Sénégalaise Contre le Cancer) achieve workshops on cervical and breast cancer prevention programme.

In Senegal, there is only one public hospital in the country which is out of date and cramped, but other large hospitals in the city offer some specialized services as well.

### Diagnosis and Treatment

The majority of cancer patients in Senegal have very limited access to diagnosis and treatment services. This is mainly due to the fact that specialized services are scarce and mainly concentrated in Dakar (and then principally at the cancer centre at Aristide Le Dantec Hospital, the biggest public hospital in the country which is out of date and cramped, but other large hospitals in the city offer some specialized services as well).
leaving the rest of the country virtually devoid of specialized services. In addition, patients have to pay out-of-pocket and, more often than not, cannot afford the costly procedures and, frequently, ever a simple curse of chemotherapy.

![Figures 1-3](image)

Regarding costs of treatment and in addition to governmental funding, there are efforts from NGOs to provide financial support and reduce the cost of treatment by raising funds through donations. “Ligue Sénégalaise Contre le Cancer” (LISCA) covered from 2010 to 2012 an average $10,000 USD for each patient treated.

![Figure 4: Cobalt machine](image)

![Figure 5: HDR brachytherapy machine](image)

Patients sharing beds to receive chemotherapy or waiting outside facilities.

Human resources available for cancer diagnosis and treatment are restricted. There is only one pathologist at Aristide Le Dantec hospital which includes the cancer centre and results might take over six weeks to be ready. It is possible, and it happens quite often, that samples are sent to be analysed by a pathology lab in France, resulting in increased cost for patients.

The cancer centre in HALD has one operating Teleradiotherapy Co 60 unit and one HDR brachytherapy machine. The cobalt machine is a donated second hand machine, thanks to the support of the Institut National du Cancer de France (INCA). The HDR machine is a donation too, thanks to Radiating Hope, a United States association based in Utah but because of inadequate infrastructures, this HDR machine was put in the cobalt bunker and used only for cervical cancer under local anaesthesia. There is no computer-assisted planning system or adequate quality control and assurance equipment. The unit treats around 50 patients per day. The majority are cervical and breast cancer patients.

Aristide Le Dantec hospital has a paediatric oncology unit that was created ten years ago and that was reinforced in 2005 thanks to the support of UICC programme, “My Child Matters”. The unit sees 150 patients per year. It is estimated that only 20% of paediatric patients have access to treatment. There is no radiotherapy service available for children. Drugs for paediatric patients are offered as donations by GFAOP.

**Conclusions**

Senegal NCP has been strengthened by the technical assistance and support provided by WHO, IAEA and other partners. However, there are important gaps and barriers that need to be addressed in order to achieve significant progress in the fight against cancer in the coming years.

- MOH should increase budgetary resources dedicated to cancer control programme in order to:
  - Set up a sustainable tumour registry
  - Prevent tobacco use specially among young people
  - Develop accurate and cost effective early detection method to prevent cervical and breast cancer
  - Put in place affordable chemotherapy regimens
Sudan was, until recently, the largest country in Africa, with an area of about one million square miles (2,505,810 km²) and a population of nearly 40 million, of which about 15% live in Khartoum, the capital city. In July 2011, the country split into two countries following the vote for independence of South Sudan. The northern Sudan is now officially called the Republic of the Sudan, the third largest country in Africa (after Algeria and the Democratic Republic of the Congo) and also the third largest country in the Arab world (after Algeria and Saudi Arabia). The country is bordered by Egypt to the north, the Red Sea, Eritrea, and Ethiopia, to the east, South Sudan to the south, the Central African Republic to the southwest, Chad to the west and Libya to the northwest. This country sits between North Africa, Sub-Saharan Africa, and the Middle East. It has an ethnic mosaic of about 700 tribes and a broad climatic diversity. Sudan is divided into 18 states, further divided into 133 districts.

In Sudan’s 2008 census, the population of Western and Eastern Sudan was recorded to be over 30 million, putting present estimates of the population of Sudan after the secession of South Sudan at a little over 30 million people. The population density is markedly uneven. The current average of 10.2 persons per square kilometre would imply that the country is sparsely populated, but in fact, there are densely populated areas and vast areas that are almost or completely unenriched. The population structure is young, with 40% under 15 years old (Sudan Demographic and Health Survey 2018/1990, 1991, 2021). 20% between 15 and 24 years old, 31% between 25 and 54 years old, 3% between 55 and 64 and 3.3% of 65 years old and above (2014 estimates). The male/female ratio is higher than 1 for most age categories with 1.03, 1.07, 1.13 and 1.21 for the age categories of 0-14, 15-24, 25-64 and 65+, respectively. For the 25-54 years old category, the male/female ratio was 0.94 (2014 estimates).

There has been a relatively small but significant increase in life expectancy, from 36.3 and 39.1 years in 1955 for men and women respectively, to 55.6 years for men and 58.4 years for women in 1999. The epidemiological profile is largely dominated by communicable diseases such as malaria and tuberculosis, as well as diarrheal diseases and respiratory infections. In addition to the burden of non-communicable diseases, Sudan is also experiencing a rapidly increasing burden of non-communica

The nuclear medicine department is equipped with one gamma camera and one SPECT. The staff is composed of one specialist, two radiographers, two pharmacy technicians and one radio-pharmacist. The staff comprises 25 radiation oncologists, 65 radiation technologists, 10 medical physicists and 10 biomedical maintenance engineers. Regarding nuclear medicine, RICK is equipped with a SPECT gamma camera, a radioiodine facility, isolation rooms, and staffed with four nuclear medicine specialists and 16 nuclear medicine technologists. In the diagnostic radiology department, RICK has two conventional X-ray machines, an ultra-scanography machine, CT machine, three radiographers and five technologists.

There are an estimated 500 paediatric cancer cases per year in Sudan, of which 40 percent are treated at RICK, where there are 14 paediatric beds available and where roughly 30 paediatric patients are seen per day. For chemotherapy, 80 beds are available for male and female patients. Chemo-radiation is being used for 25 patients daily. Overall, 140 - 150 patients receive chemotherapy daily.

While infectious diseases are still the main concern of the healthcare system, Sudan, as most sub-Saharan African countries, needs to face a predicted increment in cancer incidence because of the progressively rising life expectancy, the wide diffusion of cancer-related infections, the mounting pollution due to urbanization and the spread of-intensive agriculture and industrialization.

Burden of Cancer

Sudan has no national population-based cancer registry. The main sources of data on cancer are the hospital-based case series at the only two oncological centres of the country, both located in the densely populated Central Sudan, i.e., the Radiation and Isotope Centre in Khartoum (RICK), Khartoum State, and the National Cancer Institute of the University of Gezira (NCI-UG) in Wad Medani, Gezira State. In addition, a newly established centre in the north of Sudan (Shandi) is operating at small scale and providing chemotherapy only.

RICK is the main referral centre, treating the largest number of cancer cases in Sudan. Almost fifty per cent of female cancers seen at RICK are breast (25-30%) and cervix (12%). The predominantly prevailing male cancers are prostate (17-20%), head and neck (10-12%) and cancers of the oesophagus. The department of radiation oncology has four external beam machines (two linear accelerators, two Cobalt-60). The staff comprises 25 radiation oncologists, 65 radiation technologists, 10 medical physicists and 10 biomedical maintenance engineers. Regarding nuclear medicine, RICK is equipped with a SPECT gamma camera, a radioiodine facility, isolation rooms, and staffed with four nuclear medicine specialists and 16 nuclear medicine technologists. In the diagnostic radiology department, RICK has two conventional X-ray machines, an ultra-scanography machine, CT machine, three radiographers and five technologists.

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The NCI is based in Wad Medani, roughly three hours from Khartoum. It provides medical care for cancer patients from Gezira State as well as the surrounding states in the central region of Sudan. NCI is composed of two buildings, one of which is currently undergoing a US $18 million construction for expansion of the hospital. The new building will be comprised of five floors and 120 beds. Once completed, the centre will have capabilities in chemotherapy, surgery, radiation, operation theatres, palliative care and bone therapy (as part of a nuclear medicine). Regarding radiotherapy, the centre is equipped with two Cobalt-60 machines operating daily from 8:00 a.m. to 6:00 p.m. treating 60 to 90 patients daily. The centre has a conventional simulator and a treatment planning system. It had purchased a linear accelerator machine but, due to embargo imposed on the country, this unit has not been operational since installation. The staff is made up of 4 clinical oncologists, a paediatric oncologist, 12 radiographers, 3 medical physicists, and 3 biomedical engineers.

The centre is equipped with 15 dedicated chemotherapy beds and chemotherapy is provided free of charge for the patients. An average of 40 patients is seen daily.

The nuclear medicine department is equipped with one gamma camera and one SPECT. The staff is composed of one specialist, four radiographers, two pharmacy technicians and one radio-pharmacist. NCI also has a well-equipped molecular laboratory with four machines for tissue typing, used primarily for renal and liver transplant.
The radiology department is equipped with two ultrasound machines testing 40 patients daily. A mammography unit as well as conventional radiology are also available. The radiology department staff includes two specialists and six radiographers.

The Shendi Cancer Centre is a University-based centre, with one clinic, the 'elder' Shendi Centre, treating an estimated number of 375 new cancer cases per year (an estimated 75 of these cases are referred from NCI). The centre has a chemotherapy service that is run by one clinical oncologist who travels from Khartoum once per week, typically examining 30 patients per visit. The service is a day care service with 15 beds. Radiology services include conventional X-ray, ultrasound and CT scan, a radiologist and three technologists make up the staff. The nuclear medicine service is located in the cancer unit. The facility is equipped with a gamma camera and staffed by two technologists, one medical physicist and one nuclear medicine physician (currently training in Egypt). There is currently no radiotherapy service at the centre. Two oncologists are currently in training. A new campus is under construction at the Shendi Cancer Centre, consisting of five buildings and will soon open, although it is not yet ready to receive cancer patients.

In 2006, the NCI University of Gezira, supported by the International Agency for Research on Cancer (IARC), established the first population-based cancer registry in Sudan. It uses the Can Reg format. Table 1 and 2 show unpublished data on the cancer incidence per 100,000 population by age group among men and women for the period 2005-2012.

Recently, with the support from the Ministry of Health, a population-based national cancer registry (NCR) was established in Khartoum. The main goal of the NCR is creating a system that integrates regional and local data into an accessible central registry. The NCR has managed to report on 6,771 cancer cases among the Khartoum State residents, for the period 2009-2010, using passive and active approaches to collect data on cancer diagnosed by all means.

Rates were age-standardized to the 2010 Sudan Standard Population and 1966 and 2000 World Standard Population and expressed per 100,000 persons. Among the 6,771 new cancer cases registered for 2009-2010, 3646 (53.8%) cases were in women and 3125 (46.2%) were in men.

The most commonly diagnosed cancer among women was breast cancer followed by leukaemia, cervix, and ovary. Correspondingly, for men, the most commonly occurring cancer was prostate cancer followed by leukaemia, lymphoma, oral, colorectal, and liver cancers. In children less than 15 years of age, leukaemia was the most common cancer followed by lymphoma, cancers of the eye, bone, kidney, and the brain cancers.

The overall age-standardized rate (ASR) per 100,000 population was higher in women (124.3) than in men (90.8) using the 2010 Sudan Standard Population. Similarly, it was higher in women (188.6 and 206.3 per 100,000 population) than in men (145.4 and 160.0 per 100,000 population) using the 1966 and 2000 World Standard Population, respectively.

Regarding histopathology services in Sudan, there is shortage in these services, very few States have histopathology laboratories. Federal hospitals with such laboratories are Suba, Khartoum, Omdurman, military hospitals, and Khartoum North hospital. 5 out of 18 states hospitals have histopathology laboratories, the remaining states refer to the central lab in the laboratories directorate. This lab also receive biopsies from different public and private hospitals. Beside these few governmental laboratories, there are about 15 private histopathology laboratories in Khartoum state and two in Gezira state.

### Table 1: Gezira Cancer Registry, Sudan (2005-2012) – Male population

| Year | 0-64 | CUM | 6-74 | CUM | 75-84 | CUM | 85+ | CUM | State
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<td>574</td>
<td>262</td>
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<td>445</td>
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<td>269</td>
<td>852</td>
<td>451</td>
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<td>2008-09</td>
<td>601</td>
<td>281</td>
<td>882</td>
<td>463</td>
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<tr>
<td>2009-10</td>
<td>610</td>
<td>287</td>
<td>898</td>
<td>469</td>
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Cancer Management

Cancer management started at the Khartoum teaching hospital decades ago. In 1967, the Radiation and Isotope Centre (RICK) was established as a specialized cancer management centre. The efforts of the highly qualified physicians in the field laid the foundation for the present cancer control program. Nevertheless, there is a rising trend in the reported cancer cases, attributed to the growth and aging of population, increased exposure to cancer risk factors, and increased knowledge and public awareness.

Risk factors for cancer are prevalent in Sudan, as shown by the Khartoum State, stepwise risk factor survey, where the prevalence of current tobacco smoking in adults of 25 years and above was 24.7% and 2.9% in men and women, respectively. The snuff use was 25.8% in the same age group. The prevalence of overweight or obesity in adults over 25 years, was 41.4%, and 62.5% in men and women, respectively. Moreover, the respondents were interviewed about their physical activity, 58.6% stated that they were physically active. Only 25.4% had regular activity while 33.2% had irregular physical activity. 41.4% never had any physical exercise.

Sudan is experiencing many challenges that are characteristic of developing countries, including high incidence of advanced, difficult-to-treat disease at presentation and high cancer burden that is related to infectious diseases. Cancer is a major cause of morbidity and mortality in Sudan, ranking second as the most common cause of death after infectious diseases (mainly malaria and tuberculosis). Current cancer control efforts are fragmented and lack consistency. These efforts include prevention, early detection, diagnosis and treatment.

Prevention

Tobacco use, obesity and infections are prevalent in Sudan. Public awareness regarding cancer prevention and control is poor and expenditure on health tends to be skewed mainly towards curative and hospital care. Therefore, cancer preventive activities are limited.

For instance, hepatitis B vaccination in infancy started in 2006. Guidelines on prevention and early detection of the most common cancers, such as breast, cervix, and oral cancers was developed, in parallel with training of a few health care providers. They were developed by the National Cancer Council in 2008, when the Council had formed a dedicated committee for Prevention and Early Detection: “Guidelines on prevention and early detection of most common cancers in Sudan – Breast, Cervix, and Oral Cancers” were published in a report by the Federal Ministry of Health in September 2010. They are intended for the primary health care level and are available in Arabic and English.

Early Detection

Health education activities are scant, primary health care workers are rarely provided with sufficient education about early signs of cancer, and about when and where to refer. There are no other cancer control activities at primary health care level. There is an absence of mass screening programmes, but projects for breast cancer and cervical cancer screening are under development. This situation leads to delay in presentation which is often due also to a variety of factors, including lack of awareness of the signs and symptoms of cancer and lack of money to travel to a hospital and cover the costs of diagnosis and treatment, thus leading many to seek traditional treatments instead.

Over 70% of patients present with advanced stages, with most at stage III and IV. At the time of RICK’s inception (1967), an estimated 85-90% of cancer cases presented late, and this trend has not changed noticeably in the 45 years since its opening.

At these stages of the disease, treatment is more expensive and complicated involving multiple modalities of treatment, including surgery, radiotherapy, chemotherapy and hormone therapy, and has a markedly low chance of a good outcome.

Several factors were found to be associated with late stage presentations. These factors include a general lack of awareness and knowledge about cancer among the population and even among some medical staff, which is more serious than the former in determining early presentation. This situation could be explained by inadequate education and poverty. Also, the unequal distribution of medical/health resources in Sudan and their concentration in urban areas impede many patients seeking diagnosis and treatment.

Another factor playing a role in late presentation is the stigma associated with cancers in local communities. In fact, there is a common perception that cancer is transmissible, which results in the isolation of the patients and in the breakdown of marriages, leading patients to hesitate to disclose their symptoms and to seek proper care. In women, a barrier to early presentation are traditional healers. They usually keep women with possible breast cancers on herbal/other medications for long periods before the patient and/or the family decides to seek professional medical services.

Efforts are being made by the government to scale up cancer services at the primary health care level, notably in prevention and early detection. A pilot project started in 2012-2013 with the aim of integrating cancer services in seven states into primary health care. Training tools, provision of supplies and training courses are included in this plan. Currently, there are only 15 mammography units in Sudan, 13 of which operate in the private sector. In general, despite the high level of commitment demonstrated by the medical staff and NGOs to enhance early detection activities, these efforts are episodic and not yet sustainable.

Diagnosis

Another significant problem in combating cancer is that, even if the sign and symptoms of cancers are discovered early, the diagnostic facilities are both limited and expensive. There is shortage in histopathology services, very few States have them. Moreover, training is needed to improve the quality of histopathology reports. The Federal hospitals with histopathology laboratories (31.2%) are Suba, Khartoum Teaching hospital, Omdurman teaching, military hospitals, and Khartoum North hospital. The main problems that need to be addressed are the shortage of dedicated resources, the extremely low number of pathologists and pathology departments, the geographic distances involved, the poor SOPs used.
in sample handling, and the need for developing logistic systems for sending specimens from peripheral hospitals to centralized pathology laboratories.

Radiology services are available in almost all States especially conventional X-ray machines and ultra-sonography units. However, CT scanners and MRI machines can be found only in big cities. The national insurance covers the cost for state employees, but the rest of the patients have to cover the costs themselves, which remains impossible for the majority.

Treatment

Treatment of cancer is expensive and complicated especially in developing countries - where there is limited or no access to health insurance – simply many patients cannot afford to pursue treatment.

In Sudan, many patients and their families have to bear the full costs of their treatment. However, governmental hospitals offer admitance, investigative techniques, blood samples, scans, the drugs used to treat the cancer, as well as other treatment options such as surgery, chemotherapy and radiotherapy, at affordable cost or at no cost for state employees who are covered under the national insurance corporation. Missing diagnostic investigations are referred to private centres, which can be up to 300 times more expensive. Some tests have a waiting list of up to three weeks.

Another critical problem in Sudan is the lack of oncologists and specialized cancer nurses in each State. Oncology and palliative care are only available in the previously mentioned three cancer centres. Also, access to radiotherapy is limited; there are only two linear accelerators and four Cobalt-60 machines in working order for a population of over 30 million. These machines are present in only two centres in two adjacent states (Khartoum and Gezira) and do not cover the whole population.

Large distances that patients must travel across Sudan to seek treatment as both RICK and NCI are located in the central Sudan obviously limit the access for those who live far from these hospitals; many patients may not have the financial means to support transportation costs. Furthermore, patients and families must have sufficient financial resources to arrange for accommodation and other requirements for the duration of treatment in Khartoum or Wad Madani.

Approximately 10,000 new cancer patients are diagnosed each year in Sudan. RICK receives an estimated 7,000 – 8,000 patients while another 1,500 are seen in NCI. There are published treatment protocols for breast and prostate cancers. In 2004, a group of surgeons, pathologists, oncologists and radiotherapists agreed to have general guidelines for the Gezira State (Gazira Guidelines for Management of Breast Cancer). These guidelines, updated in 2006 and 2010, were published and distributed to all those who are involved in the management of breast cancer patients in Gezira State. Although these protocols are widely distributed to oncologists and surgeons, and urologists, recommendations are often not followed. Although many practicing doctors who are actively involved in the management of breast cancer are currently aware of these 3 documents or at least of the last one, variation in management remains and reflects major deviation from the national/international guidelines. This can be explained by the multiple reasons. Firstly, the number of facilities for diagnosis of breast cancer is limited. Triple assessment cannot be done in most parts of the country because of limited number of mammography machines and radiotherapists. Most of the diagnostic facilities and trained personnel are in the capital. Secondly, access to histopathology facilities is also limited. The extreme shortage of pathologists and laboratory technicians is a major issue that hinders proper diagnosis and hinders initiation of appropriate treatment.

Thirdly, persons who are involved in breast cancer management have different educational bases. For example, surgeons who are among the first medical specialists to meet patients, are very much different in their training and exposure to such conditions. The majority of surgeons are not specialized in a certain branch of surgery and practice general surgery; few of them are interested in breast surgery.

Moreover, there is an extreme shortage of well-trained oncologists, radiotherapy units and chemotherapeutic agents. Above all, there is a very small number of combined breast clinics where the multimodality management of breast cancer is applied. Finally, there is no enforcement of management guidelines.

Not following national/international guidelines results in lack of consistency in treating the same cancer at the same stage in different centres. The need for standard care management protocols is obvious. For other types of cancers there is effort underway to formulate national management guidelines.

Status of Radiotherapy in Sudan

According to GLOROCAN 2008 data, there are an estimated 21,860 new cancer cases in Sudan each year. As it is estimated that 60% of patients will require radiotherapy during the course of treatment, approximately 13,116 cancer patients will need treatment annually.

Currently, Sudan has two linear accelerators and four Cobalt-60 machines in working order for a population of over 30 million. The government has a plan to establish 5 new radiotherapy centres which will ease the need and relieve the pressure on the existing centres. The department of Radiation Oncology at RICK has four external beam machines (two linear accelerators, two Cobalt-60). The external beam machines work in three shifts starting from 6:00 a.m. to 2:00 p.m. On a typical day, 190 - 200 patients are treated on all machines. The waiting period ranges from one day to three months depending on curative or palliative intent. Seventy per cent of patients are treated with palliative intent and the remaining 30 per cent with curative intent.

Repair and maintaining uptime of radiotherapy equipment is a challenge. As there is neither a maintenance contract nor budget for maintenance of equipment, machines can sometimes be out of order for several months at a time leading to insufficient radiotherapy provided to cancer patients. A quality assurance program for radiotherapy is in place at RICK.

NCI is equipped with two Cobalt-60 machines operating daily from 8:00 a.m. to 6:00 p.m. which treats 60 to 90 patients daily. The waiting list is one week for patients beginning radiotherapy. Treatment and dose schedules are radical and curative for half of the patients and palliative for the remaining half. The centre does not have a brachytherapy machine and a request to the IAEA has been put forth for a high-dose rate brachytherapy machine. There are no budgets or maintenance contracts in place for the majority of equipment at NCI, but a quality assurance program for radiotherapy is established.

Status of Chemotherapy in Sudan

At RICK, 80 beds are available for male and female patients in chemotherapy. Chemotherapy is being used for 25 patients daily. Overall, 140 - 150 patients receive chemotherapy daily.

NCI is equipped with 15 dedicated chemotherapy beds. Chemotherapy is provided free of charge for an average of 25 patients daily. NCI has 47 inpatient beds for men and women. The centre has also two paediatric oncologists who are treating 100 patients annually.
The State of Oncology in Africa – 2015

For male and female patients receiving treatment at NC, a 50-bed boarding house located in the vicinity of the hospital is made available for longer term stays. The house hosts a kitchen for patients and families staying at the facility, and offers patients (who sometimes travel from neighboring countries) a chance to finish treatment while remaining on site.

Although NC was established more recently (1994) and has small number of doctors and machines in comparison with RICK, the centre is more stable in terms of providing radiotherapy and chemotherapy and it continues to prove itself an effective back up for RICK.

Shandi centre has a chemotherapy service run by one clinical oncologist who travels from Khartoum once per week, typically examining 30 patients per visit. It is a day care service with 15 beds and a centralized area for chemotherapy preparation. One clinical pharmacist and three nurses treat 10-12 patients per day.

The problems related to chemotherapy, hormonal therapy and new agents as targeted therapy: these problems include a lack of knowledge of the real needs, their availability and sustainability, their rising cost, the rising number of patients, the inadequate budget for supporting poor patients, the inadequate number of well-trained staff - pharmacists, chemotherapy nurses and inadequate facilities to prepare chemotherapy agents.

Status of Palliative Care in Sudan

A British palliative care nurse living in the United Kingdom volunteered to conduct a series of lectures on palliative care for nurses working at Radiation & Isotopes Centre Khartoum (RICK) and Soba University Hospital (SUH). A clinical oncologist and a nurse from SUH attended the comprehensive 5 weeks training of palliative care (PC) in Hospice Africa Uganda in October 2009. Subsequently, a series of introductory palliative care courses were conducted at RICK and SUH by trainers from outside Sudan. In January 2011, the palliative care ward was opened with special funding from Africa Palliative Care Association, representing the site for Sudan’s first palliative care service. From here, palliative care is spread to the other two centres (SUH & NC).

The service includes: an out-patient clinic, a ward with 9 beds and a palliative care unit.

The out-patient clinic opens daily five days a week and accepts patients from other oncology units at the centre or from outside the hospital. The ward with 9 beds acts as a demonstration site for holistic nursing care, continuity of care, networking, and effective communication with patient and family members. Patients are usually admitted for symptom control or end of life care, the majority of admissions are for duration of less than five days. In the palliative care unit, the nurses and doctors train the care givers in how to look after and perform dressing of fungating wounds, giving medications, physiotherapy for bed ridden patients, healthy nutritional advice and general care for bed ridden patients.

Since their inception, palliative care services at RICK introduced major changes in the hospital/ doctors’ practices. For example, symptoms burden in patients with advanced cancer (emotional and spiritual distress) are being addressed and talked about. Also, psychosocial issues of the patients such as wives being abandoned because husbands believe their cancer is incurable or even contagious or the fear of touching their chest after mastectomy or wash that area for long time, are being addressed. Care givers are facing stress to look after their beloved ones. Continuity of cancer care is ensured (including for example contacting patients by phone). Metronidazole crushed tabs is used for fungating wounds (a practice exported from Hospice Africa Uganda). Patients and their care givers are trained to perform wound dressing simply at home. Good communication skills and creating long-standing, strong and good relationship between patients and PC team members help patients understanding their prognosis and empower them to follow treatment and make life decisions. Telling the truth on the prognosis gives patients a chance to disclose very important issues in their lives and breaks any conspiracy of silence at those important days of life. It is also important to prevent any futile care, and avoid continuously looking for costly treatment in the country or abroad without any evidence of benefit.

All these interventions lead to better outcomes and improved quality of life. With the introduction of palliative care principles, patients and families receive proper care and greater level of support, to a degree that patients ask when they can be transferred to the palliative care unit (PCU).

To July 2014, 1,249 patients have been referred and offered Palliative Care services and 700 patients have been admitted to the PC ward. As breast cancer is the most common cancer among women in Sudan, all patients referred during the mentioned period were reviewed regarding breast cancer diagnosis. Breast cancer was found in a total of 107 patients, among which 104 were referred permanently to the PCU, and only three patients were jointly taken care of with the oncology department. 32 patients were referred with pain, three patients were referred for end of life care, eleven patients were referred because of cessation of curative treatment and eight patients were referred for psychological support.

In spite of the urgent need for Palliative Care in Sudan, the available services exist only in three Institutes. There are limited PC services at RICK, SUH, and NC. International PC associations have a strong hand in backing these services. Also, the lack of oral opioids elsewhere limits pain management. Palliative care in Sudan is a fairly new concept but has proved worthwhile in alleviating patients’ symptoms and helping families of patients with cancer.

A lot of effort is requested from stakeholders to expand and cover all those who are in need.

Sudan National Cancer Strategy

Sudan developed a ‘National Cancer Strategy 2012-2016’ that incorporates most major components of a comprehensive approach to tackle cancer. The strategic document has laid a strong foundation for what could be the next phase of planning, where action items, timelines and budgets for activities are developed.

Conclusion

Many factors facilitate successful implementation of the National Cancer Control Program in Sudan. These are a strong commitment to fight cancer, especially during the last years and due to the increased number of patients diagnosed each year. Infrastructure exists; it can be strengthened and further developed to be used in different aspects of cancer control.

References

Tanzania is an East-African country located within the African Great Lakes region. It has a total area of 945,087 km² (364,900 square miles). The area of Tanzania includes the islands of Mafia, Pemba, and Unguja; the latter two form a semi-autonomous region called Zanzibar, which is part of an official union with the republic of Tanzania. In 2014, Tanzania had a population of 51.82 million, with a male/female ratio of 0.99. Tanzania’s population is characterized by a young age structure, with 43.9% of the total population below age 15 years and only 5.6% of the Tanzanian population aged 60 years and above. Also, life expectancy is 60.85 years. The majority of Tanzanians (69%) live in the rural areas. According to 2010 statistics, the adult literacy rate is 67.8%.
Chapter 16q – Tanzania

Cancer Incidence and Mortality

Currently there is no established population-based cancer registry existing in Tanzania. However, there are institutional registries (hospital based registries) at Ocean Road Cancer Institute (ORCI) and Kilimanjaro Christian Medical Centre (KCMC).

Figure 2 presents trends of cancer incidence and mortality from the ORCI registry for patients who were attended from 2006 to 2014.

As it can be clearly observed, the number of new cancer cases is increasing every year. This data does not show the true picture on the ground, because most of cancer patients do not reach ORCI for treatment, and some are treated at Bugando Medical Centre and the Aga Khan hospital. Moreover, a great percentage of patients do not come back for follow up after treatment.

Cancer Centres in Tanzania

Currently, Tanzania has a one radiotherapy centre, the Ocean Road Cancer Institute in Dar es Salaam, located along the Indian Ocean, about 200 meters from the beach. This health facility is one of the oldest health institutions in Tanzania having been founded in 1895 by the German colonial government. It receives cancer patients from all over the country, having an inpatient bed capacity of 257 people and 190 people for outpatient. However, the hospital is sometimes forced to deal with much larger numbers.

There is an Oncology paediatrics ward at Muhimbili National Hospital, with an inpatient bed capacity of 23 people. The national hospital is about 4 kilometres from Ocean Road Cancer Institute.

Bugando Medical Centre is a consultant and teaching hospital for the lake and western zones of Tanzania. It is situated along the shores of Lake Victoria in Mwanza, in North-Western Tanzania. It has 900 beds and over 900 employees. It is a referral centre for tertiary specialist care for six...
regions, serving a population of approximately 13 million people. The hospital has a newly established Oncology Department which provides care for all patients with histopathologically proven cancers.

Nevertheless, the department does not currently provide radiotherapy services. As a result, patients requiring radiotherapy have to travel long distances to receive this treatment method at ORCI.

The other consultant hospital providing cancer care but no radiotherapy is the Aga Khan Hospital, a private hospital located in Dar es Salaam.

Regional Referral hospitals that provide pathology services for diagnosis of cancer diseases are the Kilimanjaro Christian Medical Centre (KCMC) which is a referral hospital for over 15 million people in Northern Tanzania. The hospital is a huge complex with 500-800 inpatients in 630 official beds.

Mbeya Consultant Hospital is a tertiary healthcare facility for the southern Highland zone in Tanzania covering the regions of Ruunya, Rukwa, Iringa and Mbeya. This hospital provides only pathology services, therefore diagnosed patients have to go elsewhere for treatment.

**Tanzania Oncological Resources**

Oncological resources in Tanzania are generally minimal and unevenly distributed throughout the country. Most of the resources are located within the city centres i.e. Dar es Salaam and Mwanza.

Newly diagnosed cancer patients need pathology, surgery, chemotherapy and/or radiation therapy. The number of oncologists needed is therefore based on the number of patients.

**Medical Oncology in Tanzania**

**Hospitals currently providing Chemotherapy services**

Chemotherapy is provided at Ocean Road Cancer Institute, Bugando Medical Centre, Muhimbili National Hospital-Paediatric Ward and in private hospitals.

**Chemotherapy Drugs**

Usually, there is shortage of chemotherapy drugs in public hospitals. If available, the chemotherapy is free of charge, but if case of drug unavailability at a government hospital, the patient is given a prescription to buy the drug in private pharmacies. If a patient has health insurance, they can acquire the drugs through their insurance. If not, they have to buy it at their own expenses which represents a huge burden because most of them can’t afford it.

**Radiotherapy Sources**

Radiotherapy services started in 1980s; and nowadays, about 90% of cases require radiotherapy. At ORCI, there are two Cobalt-60 machines, and two Linear Accelerators are expected very soon. There is also one simulator machine.

There are also Brachytherapy services at ORCI. Brachytherapy is mainly used for treatment of cervical cancer. ORCI has currently two HDR intra-cavitary machines.

**Pathology Resources in Tanzania**

There are about twelve pathologists in the country, among which six are at the Muhimbili National Hospital. Out of these six pathologists, 3 are retirees, 1 is part of the administration, leaving two full-time working pathologists. The other six pathologists are distributed as follows: two in the Mbeya referral hospital, two in the Bugando Medical Centre, one in the Ocean Road Cancer Institute and one in the Kilimanjaro Christian Medical Centre.

These human resources are not enough compared to the number of new cancer patients per year. Turnaround time is about 4 to 7 days for soft tissue tumours and about 3 days for Fine Needle Aspiration Cytology.

There are few Histo-technology laboratories in the country: three at Muhimbili National Hospital, two at KCMC and two at Mbeya Referral Hospital. There is no available Molecular Lab in the country, but immunopathology tests are available for breast cancers, lymphoma and some soft tissue tumours but they are not done for all the patients mainly because of their high costs; most patients cannot afford them and the Government doesn’t subsidize them.

**Oncologists in Tanzania**

In Tanzania, doctors are trained to be clinical oncologists in contrast to other countries where the functions of medical oncology and radiation oncology are clearly separated and defined. This is done accordingly to the recommendations of the International Atomic Energy Agency (IAEA)
for developing countries, which consist in training Radiation/Clinical Oncologists who can prescribe both radiation and chemotherapy for the common solid cancers, instead of separate medical and radiation oncologists.

Currently at ORCI, there are 21 Clinical oncologists, with the majority of them having been trained in the country. The Mmdd Clinical oncology program started in 2010 under MUMAS having its department at ORCI. In BMC, there is one medical oncologist and one radiation oncologist, while in the private sector, Aga Khan Hospital has one Medical Oncologist.

Also, there are two Paediatric Haematologists at Muhimbili National Hospital working in the oncology paediatrics ward.

The National Cancer Control Strategy

Since the day that Tanzania got its independence, there have been efforts in dealing with issues that were a threat to the country’s development including diseases such as cancer, one of the leading causes of deaths. It is estimated that 109 new cancer cases and 89 cancer deaths occur every day in Tanzania.

The Government through the Ministry of Health recognized the importance of establishing cancer services in the country since the 1970s. One of the key milestones was to establish a National Cancer Institute, the Ocean Road Cancer Institute (ORCI), in 1996, through an act of Parliament.

The ORCI managed to establish a hospital-based cancer registry, access to cancer awareness education to the public, facility-based as well as outreach-based cervical and breast cancer screening services, palliative care services and perform local and multi-centre researches.

To further strengthen efforts to fight cancer, the Government through the Ministry of Health formulated the National Cancer Control Strategy 2011-2016.

The formulation process was coordinated by the appointed national steering committee in closer consultation with various stakeholders and the public.

Hence, the national strategy reflects a shared commitment to reduce the incidence of cancer, to improve the quality of life of those who develop cancer, and to integrate cancer control and intervention services in the existing healthcare infrastructure.

Prevention and Early Detection

Cancer is still one of the serious concerns in most developing countries including Tanzania, where the incidence continues to escalate. Numerous factors have been identified to be causes of cancer in all its forms, which include among other the use of tobacco, alcohol consumption, the unhealthy diet, physical inactivity and obesity, chronic infections, hazardous materials and waste.

The only solution for the threat of increasing cancer in Tanzania is prevention. In the case prevention is not possible, other solutions are early detection, diagnosis and treatment.

In efforts to prevent the disease, the Tanzanian government has deliberately taken various measures including educating the public on various causes and prevention measures for cancer; the establishment of the Ocean Road Cancer Institute (ORCI) in Dar es Salaam, and also arrangements to sponsor health experts for specialized courses on cancer and related diseases treatments.

However, more efforts needs to be done so that the initiatives are widely spread.

For example, public education should cover schools, villages, districts, all regions, hospitals and worshipping areas. Also, establishing more cancer centres in various parts of the country is needed.

Tobacco

Tobacco is associated with three of the top five cancers at ORCI i.e. cervical cancer, oesophageal cancer and head and neck cancers. Tanzania produces about 9,600 tons of tobacco annually, about 50% is exported to industrialized countries while about 20% is processed locally into cigarettes. About 90% is cultivated by small-scale farmers and the rest by large-scale farmers. Tobacco is the sixth foreign exchange earner for Tanzania, contributing 4% of the foreign currency earnings (BOT annual report, 2004). Tobacco industry contributes about 30 million dollars annually in the form of taxes to the Government of Tanzania.

According to a study conducted in Tanzania in 2002, the number of people smoking was increasing with 27% in the male population and 5% in the female population.

Looking at the threat of this growth, the Tanzanian government passed in 2003 the law that among other actions made smoking in public illegal. However, enforcement to implement the law has not been strong enough, making the situation worse.

Additionally, companies and businesses dealing with tobacco have taken advantage of the inactive systems and regulations set by the government by increasing advertisements of cigarette brands all around the country, hence making enormous profits out of people’s ill health.

Currently, the strongest intervention to warn smokers and non-smokers on the harms of tobacco smoking and also avoiding secondary smoking, is the Tobacco Regulation Act (2003). This Act clearly indicates that “Smoking seriously damages your health, Smoking cause cancer, lung diseases, smoking causes heart and fatal diseases”.

It is therefore important that all the necessary measures are taken to create more awareness, specifically among the youth, through teaching the risks of tobacco use and also to prohibit its use in public areas and its sale near schools.

Unhealthy Diet, Physical Inactivity and Obesity

Unhealthy diets, physical inactivity, and obesity are associated with risk of several cancers such as colon, endometrial, postmenopausal breast and pancreatic cancers.

There is an increase of obesity in Tanzania which has mostly affected the population in the urban areas. The main cause for this has been consumption of unhealthy foods and less physical activity in daily life. In the past, it has been thought that obesity affects only adults, but now this health condition affects also to the large extent children and youth.
Engaging in physical activities and/or sports contributes greatly to a healthy life. Hence, it is important that individuals are motivated to participate in physical activities which are the basis of building a good health and trend.

**Hazardous Materials and Waste**

Increasingly hazardous waste mismanagement and general environmental pollution are issues of concern in Tanzania. Formerly, these issues were not given much attention mainly because of the limited awareness and also due to financial and technical constraints. Tanzania has suffered severe consequences, in particular, the increased number of cancer cases arising from hazardous waste and environmental mismanagement.

Various initiatives have been taken by the Government of Tanzania in addressing this particular challenge, including establishment of policies, legislations and regulations, being part of the Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and their Disposal, and Bamako Convention on the Ban of the Import into Africa and the Control of Trans-boundary Movement of Hazardous Wastes within Africa. Despite existing challenges, the country is obliged to take necessary measures to ensure sound management of its environment through community awareness programmes.

**Infections**

In Tanzania infectious agents have been the major causes of the most diagnosed cancers such as cervix, liver, and bladder cancers and Kaposis Sarcoma. In 2012, for example, Tanzania had 33,884 new cancer cases among which infection-associated cancers represented a great proportion.

However, the link between cancer and infectious agents also means that the problem is potentially preventable and the rates of cancer could be reduced through awareness campaigns, education on infection prevention and further insurance of an extensive accessibility of vaccines. Early screening and detection is key to enhance survival and quality of life of cancer patients.

**Cancer Control in Tanzania**

**Prevention**

Prevention services include the use of health protection, health promotion and disease prevention strategies to alert the population to cancer risks, promote healthier lifestyles and create healthier environments that aim to reduce potential cancer risks.

**Liver Cancer**

Primary liver cancer is mostly attributed to Hepatitis B virus. It is estimated that by the age of 15, about 80% of children in Tanzania show signs of being infected with Hepatitis B virus and approximately 10% become chronic carriers. It has been found that the majority of infections are acquired between the age of 6 months and 5 years. Hepatitis B is a major risk factor for primary liver cancer although the number of new patients seen at ORCI is less than 50 per year. A large number of patients seen in consultuant hospitals are not referred to ORCI due to limited treatment options. Hepatitis B viral infection can be prevented by vaccination with Hepatitis B vaccine, and this could help prevent liver cancer and other liver diseases such as liver cirrhosis. Currently, Tanzania provides this vaccine in its Expanded Program on Immunisation (EPI).

**Cervical Cancer**

Cervical cancer is caused by Human Papilloma Virus (HPV). The majority of women are exposed to the virus once they become sexually active. The ideal way to prevent HPV infection would be through vaccination prior to exposure. In developing countries, girls are vaccinated with HPV vaccines design to protect against infections with high risk types (HPV16 and HPV18), starting at the age of 9. However the cost remains high and it is not affordable to the majority of people, unless it is included into EPI in developing countries. Currently, in Tanzania, HPV vaccines are available commercially in private hospitals although the cost is high.

**Other Cancer Prevention Measures**

Other primary cancer prevention measures in Tanzania, although conducted in a limited capacity include: education on increased daily intake of vegetables, increased percentage of people eating fruits every day, decreasing daily intake of fat, reducing intake of alcohol to modest amounts, and well informed sexual and reproductive behaviour.

**Early Detection, Screening and Diagnosis**

Efforts have been made by the Ocean Road Cancer Institute to create public awareness campaigns on signs and symptoms of the common cancers. The unique challenge to these efforts are of financial nature. This could eventually lead to information not reaching a wider audience.

**Screening**

In 2001, the ORCI in collaboration with IARC and INCTR introduced a cervical cancer screening program using Visual Inspection with Acetic Acid (VIA) and/or Lugol’s Iodine (VILI). This screening clinic located at ORCI is run free of charge. By December 2010, a total of about 19,000 women were screened for cervical cancer, and about 20 to 25 women were screened per day. The program faces a number of constraints, especially concerning advertisement and encouraging women to attend the clinic. In 2006, ORCI received funds from the Government in order to conduct nationwide cancer control activities. These focused on cervical and breast cancer screening using VIA and BICE, respectively, in the regions in Tanzania. A total of 45,000 women were screened in 13 regions.

There are other individual-based screening programs conducted by cancer specialists in government as well as private clinics for different types of cancers. However, the screening is done on an ad-hoc basis due to various challenges, including a shortage of mammography machines.

**Diagnosis**

In Tanzania, there are no laid-down guidelines for the diagnosis and referral of cancer patients. This situation might be the cause for late cancer detection and delays in treatment.

**Treatment**

In Tanzania, options for cancer treatment include surgery, radiotherapy, chemotherapy and hormonal therapy. Treatment options may also depend on the type of cancer and stage at presentation. At the moment, ORCI is the only specialized centre for cancer treatment offering
In Tanzania, 5.1% of adults aged 15 – 49 are infected with HIV. The prevalence has dropped slightly in the country from 5.7% in 2008/2009 to 5.1%

Cancer and HIV/AIDS in Tanzania

The Health Insurance Fund (NHIF) also buys cancer drugs for their beneficiaries. When the drugs are out of stock, then patients must buy drugs from private drug stores at their own expense. The National Authority: Government and Non- Governmental institutions, pharmaceutical wholesalers, pharmaceutical manufacturers, clinical trial sponsors and principal investigators and recipients of donations.

However, individuals and hospitals can be authorized in extraordinary circumstances to import pharmaceuticals for personal and hospital use, respectively.

The Government pays for health care in public facilities, where they exist. Treatment of cancer is free in Tanzania, for patients treated at Ocean Road Cancer Institute. Other palliative care centres include Muhimba Hospice Care (offers hospital based care for HIV/AIDS and cancer patients), Pastoral Activities and Services for People with AIDS in Dar es Salaam (PAASADA; offers care for HIV/AIDS patients), Selan Lutheran Hospital Hospice in Arusha and Wenneware Hospice in Mbeya.

Drugs

The Tanzania Food and Drugs Authority (TFDA) was established under the Tanzania Food, Drugs and Cosmetics Act 2003, Cap 219, with the mission of protecting and promoting public health by ensuring quality, safety and effectiveness of food, medicines, cosmetics and medical devices. One of the TFDA functions is to conduct pre-marketing evaluation of the regulated products to ensure that they meet standards of quality, safety and effectiveness before they are registered i.e. being officially allowed into the market.

All medicines in Tanzania are imported to the country by the following categories after being given permission from Tanzania Food and Drug Authority: Government and Non- Governmental institutions, pharmaceutical wholesalers, pharmaceutical manufacturers, clinical trial sponsors and principal investigators and recipients of donations.

Cancer and HIV/AIDS in Tanzania

In Tanzania, 5.1% of adults aged 15 - 49 are infected with HIV. The prevalence has dropped slightly in the country from 5.7% in 2008/2009 to 5.1% in 2011/2012, although the infection rate has remained higher for women than for men, according to the Tanzania HIV/AIDS and Malaria Indicator Survey report for 2011/2012.

HIV is a known risk factor for cancer, with a number of cancers now being known as HIV-related malignancies: Kaposi’s Sarcoma, cervical cancer, and malignant lymphoma are cancers often associated with the HIV infection. The role of HIV in the pathogenesis of these malignancies is not well understood, and few studies have been done to determine any general increase in cancers after the onset of the HIV epidemic.

The introduction of Anti-retroviral therapy (ART) in Tanzania had a big impact in the reduction in incidence and prevalence of these cancers; this is evidenced by a study done in Tanzania at Ocean Road Cancer Institute in Dar es Salaam. This study examined the changes in proportions of Kaposi’s Sarcoma to all cancers over the period of increased AIDS management by ART (2006-2011).

The management of HIV-related cancers has been a challenge mainly due to the lack of proper treatment. Moreover, current guidelines do not support the use of standard therapy (chemotherapy and radiotherapy) to this group of patients, due to lacking evidence. Also, issues of drug toxicity and interactions with ART need further research.

While HIV-related malignancies have declined globally with ART, including Tanzania, the rates of Non Aids defining cancers (NADCs) are believed to have increased i.e. rectal cancer, squamous cell carcinoma of the conjunctiva, and Hodgkin’s Lymphoma. This is evidenced by a study done at Ocean Road Cancer Institute in Dar es Salaam Tanzania, showing an increase of NADCs over the past 11 years (2002 - 2012) among the HIV- positive patients.

This has brought an increasing burden in Tanzania, and other low and middle-income countries which led to the development of integrated programs for cancer prevention, control and HIV therapy. There is a need to identify and implement preventive measures for HIV related cancers through prevention of HIV infection.

The National HIV Prevention Strategy for Tanzania Mainland is based on the nine main strategic HIV Prevention objectives stated in the National Multi - Sectoral HIV/AIDS Strategic Framework, Established in 2009/10 - 2012. The focus is on promoting safer sexual behaviour among youth, preventing the mother to child Transmission PMTCT, reducing the risk of HIV transmission by HIV testing and counselling, increasing the proportion of sexual active adults who use condoms consistently and correctly, and increasing the number of people who know their HIV status and adopt appropriate measures to protect themselves and their partners.

Training, Education, Research, and Human Resources Development

Cancer research is necessary in order to add more scientific knowledge regarding epidemiology, curative outcomes, psychological and behavioural patterns in Tanzania. In Tanzania, the majority of cancer research has focused on epidemiological aspects and very few on laboratory and clinical aspects.

Training and human resources development has not been a major priority in the management of cancer in Tanzania due to lack of resources. This has made career development as well as improvement in cancer care throughout the country a major problem. Currently, in Tanzania, a university program offering specialized training for cancer treatment i.e. MMED Clinical oncology training and a Bachelor's degree in Radiation Therapy Technology have been established at Muhimbili University of Health and Allied Sciences.
The State of Oncology in Africa – 2015

Chapter 16

Uganda

Jackson Orem

Uganda has a strong history of medical and cancer research. This dates back to the days of missionary doctor Sir Albert Cook often regarded as the father of modern medicine in Uganda (Savage, 2007). His meticulous records (1897-1904) formed the basis of establishing cancer registration leading to the current world renowned Kampala cancer registry (KCR) (Orem et al, 2009). In 1958, the discovery of Burkitt's lymphoma, a childhood cancer, was another landmark in cancer research from Uganda inspired by the legacy of Sir Albert Cook. The establishment of the Uganda Cancer Institute (UCI) in 1967 as a dedicated cancer research centre was the culmination of this great history and tradition. Since its inception, the Uganda Cancer Institute has been at the forefront of cancer diagnosis, treatment and prevention efforts through research in Uganda and the Eastern Africa region (Olweny, 1980).

Cancer Burden in Uganda

Uganda is one of the countries with very high morbidity and mortality due to cancer. Cancer is becoming a major challenge affecting people of all walks of life with the impact felt at all levels; individuals, families and communities. The cause of the rise in cancer incidence is multifactorial ranging from environmental agents, lifestyle, infection and the HIV epidemic (Mbulaiteye et al, 2006).

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The Tobacco Products (Regulation) Act No 2. 2003
There are more than 200,000 cases of cancer per year in the country, of which 60,000 are incident cases. Each year about 46,970 deaths occur in Uganda due to cancer. In addition, the risk of cancer before the age of 75 years is 17.8%. It is estimated that in the next five years there will be 300,000 cancer cases in the country. This alarming trend is confirmed by data from the Kampala Cancer registry and at the Uganda Cancer Institute (Coghill et al, 2013; Wabinga et al, 2014).

Currently four thousand newly diagnosed cases of cancers are seen at the Institute per year, and this is only 4% of new cases in the whole country (Okuku et al, 2013). Also, the number of revisits by patients at the Institute is more than 46,000 per year. Currently, sixty percent (60%) of the cancer burden in the country is directly attributed to HIV. Moreover there is no access to funding for these cancers from HIV funds at the moment.

It has been over two decades since the emergence of HIV, a disease with one of the most profound impacts on the practice of medicine globally. Cancers seen in the context of HIV are very common in Uganda (Coghill et al, 2013).

The Ministry of Health Strategy for a Comprehensive National Cancer Control Program

Uganda has taken steps in line with the WHO recommendations to adopt a planned response to the cancer crisis by initiating the Comprehensive National Cancer Control Program CNCCP (Orem et al, 2009). The key components of this will be: Cancer Prevention, a comprehensive care delivery with a comprehensive Cancer Service network, a National Cancer Centre of Excellence at the center, Cancer service support system, Cancer Research, cancer training, Collaboration and partnership and, finally, a strong national policy backed by legislation.

The Uganda National Development Plan (NDP) 2010 and further amplified in NDP 2 clearly states that, despite the increasing burden of cancers and other NCDs, there is inadequate capacity for specialized units such as the UCI, mainly due to lack of framework to handle these diseases. It therefore proposes the need to strengthen these specialized entities with enhanced specialized human resource capacity and upgrade of
Thirdly, a project is underway in partnership with the Fred Hutchinson Cancer Research Centre in Seattle and the USAID; it will house a modern outpatient, a research laboratory and training centre. The UCI/HCCA is a partnership between the UCI and Fred Hutchinson Cancer Research Centre (Fred Hutch) that seeks to reduce the global cancer burden through the prevention, early detection, diagnosis and treatment of cancer, infectious diseases and other health-related concerns in Uganda.

The new state-of-the-art UCI-Fred Hutch Cancer Centre was commissioned by the President of Uganda, Yoweri Kaguta Museveni, on the 21st May 2015.

Integration of Services

Despite statistics showing the increasing burden, cancer services provision in Uganda has not improved substantially over time. The occurrence of cancer and feedback from patients' experiences show inequalities between services for cancer. A great number of cancer deaths are undiagnosed; this is reflected by the very low cancer survival rate in the country and also by the increasing number of patients accessing care abroad. This is the main reason behind initiating the comprehensive cancer service network core to a functional comprehensive cancer control program. This approach is already being implemented, with the assumption that the public sector, non-governmental organizations, academia, and the private sector can share with each other skills, knowledge, and resources in implementing cancer control. This network model of services integrate community, hospitals, regional and national cancer centres with a coordinating oversight being provided centrally at the Uganda Cancer Institute. The service points of the network are located in community health centres, district hospitals, regional cancer centres and national cancer centres of excellence.

It is envisaged that an increasing level of sophistication and well trained personnel will develop over time with an integrated system, with a leadership and organizational structure and a cancer care pathway linking the primary care services to the established regional and national cancer care centres, as a conduit along which patient traffic will flow back and forth. This organization of cancer services will ensure that patients receive the highest standards of care possible and that their care doesn't depend on where they live or who they are. The population should be aware that the presence of services and sharing of expertise should be the hallmark of the network.

Cancer Prevention

Cancer prevention is part of the health promotion, a component of public health that tackles the major determinants of health to achieve health and social changes that can improve the health of the whole population. The high rate of infection-related cancers in Uganda makes cancer infrastructure. This is further echoed by the Uganda National Health Policy 2010. They encourage improved access to quality services by strengthening the development of specialized care such as those offered at the Uganda Cancer Institute and other tertiary care facilities. In line with this, the Health Sector Strategic and investment plan 2010/11-2014/15 came up with plan to establish national infrastructure and human resource capacity building for NCDs. This is further echoed in the recently launched National Health Strategic plan 2015-2020.

Update on Cancer Service Provision in Uganda

The Uganda Cancer Institute is currently the only dedicated centre for cancer treatment in the country. It is an institute of the Government of Uganda’s Ministry of Health with a fourfold mission and vision: research into the causation, treatment and prevention of common cancers in Uganda; provision of optimal clinical care that is guided by results of research, provision of training for health care professionals using the cancers seen at the UCI as the foundation for improved cancer treatment and clinical role is underway, through major investment in infrastructure. First and foremost, the Government of Uganda has embarked on the construction of a new radiotherapy block adjacent to the completed six level wards. Secondly, two projects have been completed; a six level cancer building comprising an imaging centre, clinical laboratory, intensive care unit, chemotherapy infusion centre (Figure 3) and three levels of ward space have been completed and the process of equipping and furnishing is in progress. A community cancer clinic has been developed in a rural district of Mayuge; it will serve as pilot project in understanding the cancer burden in a rural population.

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Figure 4: The commissioning of the new UCI-Fred Hutch Cancer Centre - a state-of-the-art cancer care centre

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Figure 3: New cancer building at the Uganda Cancer Institute

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A stringent anti-tobacco law has been passed by Parliament of Uganda that will curtail the availability of cigarettes, hence protecting the population from the harmful effects of tobacco. If it is not controlled, smoking will substantially contribute to cancer burden in the country in the future; 75% of patients with oral cancer had a history of smoking, with the number of years of smoking ranging from two to 33 years. Almost a quarter of Ugandan men (22%) aged between 15 and 49 are smokers, while 4% of women are smokers. Exposure to second hand smoke is known to increase the risk of lung cancer by 20-30%. The Ministry of Health is encouraging lifestyle changes aimed at mitigating diseases such as cancer, through its Non-Communicable Disease program. Increasing fruit and vegetable consumption is being encouraged as a strategy to reduce risk of cancer. Reduction in consumption of alcoholic beverages is another strategy being promoted as a measure to prevent the risk of cancers of liver, oral cavity, pharynx, larynx and oesophagus among others.

General Cancer Awareness and Cancer Screening

Cancer screening is being encouraged in the country, even if at the moment most screening are being done opportunistically. Population-based screening will be the goal and strategy in the future. The UCI is the spearhead of this encouragement through its Comprehensive Community Cancer Program (CCCP). This program, started in 2009, empowers communities with knowledge in cancer prevention, early detection, diagnosis and treatment so that they can play their rightful role in cancer control. The main objectives are to raise cancer awareness, to improve cancer prevention, to increase early diagnosis and to achieve compliance among those already diagnosed with cancer. Since most cancers are diagnosed at advanced stage, it is hoped that the screening program will lead to early detection and increase prospects for the implementation of curative therapy for more cancer patients. Greater awareness should encourage early recognition of disease, preferably before development of symptoms, hence effective treatment and better outcome. Already common cancers are particularly targeted with specific interventions; cervical cancer (Pap and HPV), breast cancer (breast awareness), prostate examination among others. We hope to reinforce our awareness program with increased access to cancer information targeting both the public and health professionals with electronic and other media platforms.

Partnerships, Collaborations and the Role of Civil Society

There is a need to provide holistic support to cancer patients and families by dealing with emotional and practical challenges of the disease. This includes the reduction of level of distress due to cancer regardless of prognosis. A significant part of this work in Uganda has been done by the NGO sector. They have however been working hand in hand with government in implementing their agenda. This is most visible in palliative and hospice services in the country which are being run almost entirely by civil society organizations. This has led to practical support being rendered to hundreds of individuals and families dealing with everyday concerns related to cancer. There is however still need to expand these roles by developing a more structured partnership with the NGO to ensure provision of services as complementary to government services. A code of practice should be developed for NGOs in cancer support through an umbrella body such as the Uganda Cancer Society to help with implementation and development of best practices for cancer support groups and NGO/NGOs working on cancer are active under the umbrella of the Uganda Cancer Society which, in turn, is part of the Uganda Non-communicable Disease Alliance (UNCDMA).

Overview of Cancer Care Network

A comprehensive cancer service network is being developed, comprising all modalities for cancer management with a referral system linking lower health levels and higher health centres progressively from district to regional and National centre of excellence.

National Centre of Excellence

This will consist of clinical care team; Surgical oncology, Gynaecological oncology, Medical oncology, Paediatric oncology, palliative care specialists and Radiation oncology. Within this will be a National Cancer Diagnostic Centre with the following components: the cancer reference laboratory, the National Cancer Imaging Centre, the National Tumour Bobank and Resource Centre. Other services to be offered will include supportive and palliative care.

Regional Cancer Centres

Regional centres will be developed with services increasing specialization and presence of multidisciplinary team. Regional cancer centres shall be rolled out in phases and shall constitute infrastructure, human resources and equipment necessary to ensure a functional multidisciplinary cancer care team. We envisage that regional centres will have a radiotherapy unit equipped with a Cobalt 60 tele-therapy unit, a simulator, a high dose rate Brachytherapy unit, a planning unit and a linear accelerator.

Research

Cancer research best exemplifies research being a key factor in promoting health, combating disease, reducing disability and improving quality of care. Cancer research is an essential component in the development, implementation and evaluation of a national cancer control programme. The scientific basis for identifying the causes of cancer and for specifying effective strategies for the prevention, treatment and control of cancer, as well as for assessing overall programme performance, rests with cancer research. The scope of cancer research is wide, extending over a number of key areas: Epidemiological research, Prevention research, Laboratory research, Clinical research, Translational research and Health services research. One of the key aspects of research with implication to cancer control is the Kampala Cancer Registry. Established in 1951 and based at the Makerere Medical School, it has collected a unique data set that has been instrumental in improving understanding of cancer in Uganda and informing health policymaking and planning. These data comprise demographic information, diagnosis information, and the source of the data. The KCR has provided data to global publications, catalyzed collaboration and research opportunities with universities and other organizations, supported training, and guided design of cancer control programs.

Cancer Training and Capacity Building

The East African Centre of Excellence in Oncology at Uganda Cancer Institute in collaboration with Makerere University proposed a project for cancer training. The main aim of this project is to strengthen and expand the Education mandate and role of the Uganda Cancer Institute as a centre of excellence in higher education in oncology education in East Africa. The main objectives of this project are to improve the level of care and research through trained man power, to improve the quality of care through higher education and professional development in oncology.
and to contribute towards prevention and control of cancer in the region through higher education. Of note is the key training collaboration with several African countries being spearheaded by IAEA/WHO through the imPECT program, the VuCCNet with proposed secretariat at the UCI in collaboration with Makerere University.

**Conclusion**

With a strong historical background in medical and cancer research as a basis for current practice, Uganda is in a better position to face the current upsurge in cancer burden, compared to many countries in the region. The Ministry of Health Strategy for a Comprehensive National Cancer Control Program shall take the right steps in line with the WHO recommendation to respond to the cancer crisis. The key components of this will be Cancer Prevention, a comprehensive care delivery with a National Cancer Centre of Excellence at the centre, a comprehensive Cancer Service network, Cancer service support systems, Cancer Research, cancer training, partnership and finally, a strong policy. Given its clear and focused mission and mandates at the centre of NCCP, the Uganda Cancer Institute is a major asset in the hands of Ministry of Health.

Uganda: National Cancer Control Plan Outline

![Figure 5: Outline of comprehensive national cancer control program for Uganda](image-url)
Zimbabwe is a southern African country with a total area of 390,757 km², divided into 10 provinces. According to the 2012 census, Zimbabwe has a total population of approximately 13 million, with a slight preponderance of women. The population is relatively young, with 41% being below the age of 15 years and only about 4% being 65 years and above. Life expectancy from birth is 58 years old. The vast majority of the population (65%) lives in rural areas, and 58% of the population is married. People of African ethnic origins make up for almost the entire population (98%).
The State of Oncology in Africa – 2015

Chapter 16 – Zimbabwe

The burden of cancer is increasing in Zimbabwe, following the regional and global trend. The Zimbabwe National Cancer Registry (ZNCR) reported more than 6,000 new cancer cases diagnosed in 2012 and over 6,500 new cases in 2013.

Generally, trends in the last decade show a steady increase in the incidence of cancer. This has been attributed mainly to a continued increase in HIV-related cancers and lifestyle related factors.

The same tendency applies also for some individual cancers such as prostate cancer, which is the most common cancer in Zimbabwean men (See Figure 3).

Zimbabwe: Prostate Cancer Trends

![Figure 3: Prostate Cancer Trends in Zimbabwe: 2005-2013 (ZNCR)](image)

Cancer Incidence

The most frequently occurring cancers among Zimbabweans of all races were cervix uteri (18%), Kaposi’s Sarcoma (10%), prostate cancer (7%), breast cancer (7%), non-Hodgkin lymphoma (6%), non-melanoma skin cancer (6%), oesophageal carcinoma (4%), colorectal cancer (4%) and eye malignancies (3%). The other cancers accounted for 35% of the registered cancers as shown in Figure 4.

Zimbabwe: Registration of Cancer Data

![Figure 2: Registration of Cancer Data: 2005-2013 (ZNCR)](image)

According to the most recent global literacy list (Unesco Institute for Statistics, 2013), the adult literacy rate in Zimbabwe in 2011 was 83.6%.

75% of households have access to potable water that is either piped or comes from boreholes and protected wells.

Cancer Registration and Burden of Cancer

Zimbabwe’s National Cancer Registry is nowadays considered a model for African population-based registries by many international organisations such as the International Agency for Research on Cancer or the African Cancer Registry Network.

The registry has contributed significantly to the development of cancer registration and surveillance in sub-Saharan Africa by providing technical support to other registries in the region.
In 2013, childhood cancers represented 3.6% of all the cancers recorded. A total of 236 childhood cancers (age 0-14) of all races were registered. They occurred in 123 boys (52.1%) and 113 girls (47.9%). The five most frequently occurring cancers in boys classified according to the ICCC system were lymphoma (17.0%), soft tissue sarcomas (16.3%), leukaemia (13.8%), retinoblastoma (12.2%) and renal tumours. For the girls, the five most frequent cancers were renal tumours (19.5%), soft tissue sarcomas (14.2%), lymphoma (11.5%), retinoblastoma (10.6%) and leukaemia (9.7%). Kaposi’s Sarcoma accounted for 41.7% of the soft tissue sarcomas in both boys and girls.

Cancer Mortality

Mortality of cancer in Zimbabwe almost mirrors the incidence in percentages per type of cancer. This might be an indication of non-robust screening programs such that deaths from curable cancers remain common. It is also well known that the majority of cancers are diagnosed late, regardless of them being preventable or not. In such circumstances, any intervention would not yield outcomes related to improvement of survival.

Liver and lung cancer emerge however as the 7th and 8th causes of cancer mortality respectively, due to their relative resistance to treatment.

As expected in a tropical environment, non-melanoma skin cancer was the most frequent cancer among Zimbabwean non-black men (52.8%) in 2013. The second most common cancer was prostate cancer (12.1%), followed by colon cancer (4.8%), cancer of the rectum (4.3%) and lung cancer (2.6%). The five most frequent cancers in non-black Zimbabwean women were: non-melanoma skin cancer (43.7%), breast cancer (21.3%), colon cancer (7.5%), lung cancer (6.3%) and non-Hodgkin lymphoma (4.9%). Melanoma skin cancer ranked sixth in both men and women of non-black origin (2.6 and 2.3% respectively).
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There are however, haematologists who practice hemato-oncology and administer chemotherapy for hematologic malignancies. In addition, there is a Kaposi’s Sarcoma clinic run by physicians interested in the disease who administer chemotherapy for this condition only.

Chemotherapy is administered at Parirenyatwa and Mipilo Hospitals and a few other private institutions. There is limited availability of chemotherapy drugs in the public sector and most patients acquire them at their own expense. The cost of these drugs is prohibitive since free access is often not provided.

Even in the private sector, there are shortages of chemotherapy drugs. These factors commonly lead to disruption of patients’ treatment and may possibly lead to poor treatment-related outcomes.

Radiotherapy Resources

Radiotherapy treatment was introduced in Zimbabwe in the 1960s with the installation of one Cobalt-60 machine at the Parirenyatwa Group of Hospitals and another one at Mipilo Central Hospital. As early as 1987, a BBC Dynaray CH-6 accelerator was installed at Parirenyatwa Hospital, followed by two LINAC 2100C accelerators installed in 1996 (one in Harare, one in Bulawayo), in conjunction with corresponding XMATRON Simulators with CT-Option.

Currently, the two cancer treatment centres have a total of five state of the art linear accelerators (LINAC) for external beam treatment (EBRT). Two additional LINACs that were decommissioned to make way for the new ones are in useable state and await construction of housing when they will be refurbished and reinstalled.

In each centre, there is a radiotherapy digital simulator, a dedicated oncology wide bore 16slice CT scanner, 2D and 3D treatment planning and oncology information systems. Appropriate dosimetry and quality control equipment for EBRT and High Dose Rate (HDR) brachytherapy are available in both centres. Although the main use of this method of treatment is for intra-cavity treatment of cancer of the uterine cervix, the equipment has some other applications. Brachytherapy is to be introduced for prostate cancer, interstitial brachytherapy and endo-cavity brachytherapy for oesophageal cancer. However, plans still need further development before

Cancer Centres

There are two major cancer treatment centres in Zimbabwe, serving both northern and southern parts of the country. These are at the Parirenyatwa Group of Hospitals in Harare (northern part) and at the Mipilo Central Hospital in Bulawayo (southern part). In addition to these, there are a few chemotherapy administration units in the private sector.

Medical Oncology Resources

Contrary to other countries where medical and radiation oncology are clearly separated and defined, the model of clinical oncology is used in Zimbabwe.

Cancer Mortality in Zimbabwe 2013 (ZNRC)

<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervix</td>
<td>13%</td>
</tr>
<tr>
<td>Lung</td>
<td>6%</td>
</tr>
<tr>
<td>Breast</td>
<td>7%</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>7%</td>
</tr>
<tr>
<td>Kaposi’s Sarcoma</td>
<td>5%</td>
</tr>
<tr>
<td>Prostate</td>
<td>9%</td>
</tr>
<tr>
<td>Oesophagus</td>
<td>6%</td>
</tr>
<tr>
<td>Color-rectal</td>
<td>4%</td>
</tr>
<tr>
<td>Liver</td>
<td>5%</td>
</tr>
<tr>
<td>Other</td>
<td>35%</td>
</tr>
</tbody>
</table>

Intra-cavity treatment of cancer of the uterine cervix, the equipment has some other applications. Brachytherapy is to be introduced for prostate cancer, interstitial brachytherapy and endo-cavity brachytherapy for oesophageal cancer. However, plans still need further development before
Pathology Resources

Histopathology services are centralized in Harare and Bulawayo. These services are found in both private (3 laboratories) and public sectors (1 laboratory).

It takes between 48 hours and 6 weeks to get a histology result. A number of reasons influence such time factors, including distance of the specimen collecting centre from the main hospital, time taken to approve results before dispatch and need for additional specialized tests at another institution.

Services are also greatly affected by shortage of skilled staff, with only seven pathologists for the whole country (2 in Bulawayo and 5 in Harare). It is estimated that 48 pathologists are needed for the whole population of Zimbabwe if one pathologist is to service 250 000 people.

Appropriate preservation of the specimen is needed and involves prompt immersion in formalin. Sometimes this can be challenging, especially in outlying areas where alternative means may be used and therefore may distort results.

Due to a limited number of pathologists, quick-frozen section diagnosis is not readily available. Fine needle aspiration is readily available in all hospitals, having had a recent re-emergence from the introduction of Interventional Radiology.

Immunohistochemistry is available but the cost is prohibitive for most patients. The immunohistochemistry tests are carried out in batches in hospitals, having had a recent re-emergence from the introduction of Interventional Radiology.

Tumour markers whilst not always available in the public sector, they are readily available in private. The following markers are usually available: CEA, CA125, CA19-9, PSA, AFP, beta HCG and CA15-3. Molecular biology is not available in the public setting. Some private laboratories offer access to tests such as BCR-ABL PCR.

Oncologists Available

The two Radiotherapy Centres in the country have eight Radiation Oncologists/Clinical Oncologists and four hematologists/oncologists who treat haematological malignancies.

There are also ten resident doctors in training in Radiation Oncology/Clinical Oncology in the local Master’s program run by the University of Zimbabwe - College of Health Sciences.

The National Cancer Control and Prevention Program (NCCP)

In recognition of cancer being a major cause of morbidity and mortality, the Zimbabwe National Cancer Prevention and Control Strategy (2014-2018) was formulated and adopted by the Ministry of Health and Child Care (MOHCC) to advocate a comprehensive cancer control policy and programme.

The document was crafted through extensive consultative processes involving national and international stakeholders and coordinated by the National Cancer Control Strategy Committee. The strategy was officially launched in February 2014.

The overall goal of the strategy is the reduction of cancer morbidity and mortality through implementation of evidence-based cost-effective prevention and control interventions and providing palliative care to improve quality of life of people living with cancer and their families by 2017. The Goal Areas are Programme Strengthening, Primary Prevention, Early Detection, Diagnosis and Treatment, Palliative Care/Rehabilitation and Surveillance and Research.

The strategy focuses on reform and reorganisation of the way cancer services are delivered in order to ensure future services that are consistent and associated with good clinical outcomes. It also seeks to ensure that cancer prevention and care across the whole country is equitable and is at the highest possible standards.

Prevention and Early Detection

The main risk factors contributing to the increasing incidence of cancer in Zimbabwe (as in most African countries) include infectious agents and lifestyle related factors such as tobacco use, harmful alcohol use, unhealthy diets and physical inactivity. Prevention becomes, therefore, the most cost-effective intervention, an approach that has been adopted in Zimbabwe.

Many of the cancers are diagnosed at an advanced stage in Zimbabwe and a great number of African countries. Moreover, due to limited resources, the current cancer treatment and palliation services are greatly burdened. A focus on screening programmes is therefore warranted.

The oncology community (including the Cancer Association of Zimbabwe) conduct cancer awareness programmes but they might not reach places where they are most needed, outside the towns of Harare and Bulawayo.

Tobacco

In Zimbabwe, cigarettes are the most common use of tobacco, smoked or chewed in various forms. Tobacco consumption is six times more common in men than in women. Exposure to passive smoking is quite common as there is no enforcement for people to smoke in designated areas. It is believed that about a quarter of adolescents in Zimbabwe are exposed to second hand smoke.

The strong commercial interests behind tobacco consumption are a major drawback to the efforts at individual and mass education against its use. The International Framework Convention for Tobacco control has remained a blue print for effective control of tobacco, outlining articles on protecting populations from exposure to tobacco smoke, implementing graphic warning signs and passing comprehensive bans on tobacco advertising, promotion and sponsorship.
Nonetheless, the Framework Convention for Tobacco Control has not yet been ratified by Zimbabwe and tobacco remains a major cash crop in Zimbabwe. Also, legislation for tobacco use exists but its implementation lags behind.

Alcohol Consumption

Ethanol is the most widely used and abused agent throughout the world. The Zimbabwe STEPwise survey in 2005 revealed that current alcohol consumption is very high with a prevalence of 38% in men and 13.5% in women. These numbers are most probably underestimated due to under reporting as a result of cultural effects, especially in women. Several measures have been adopted to try to reduce the consumption of alcohol, such as the restriction of the places and times alcohol is available, the raise of the minimum legal age at which alcohol is purchased and the increased taxation on alcoholic beverages.

Diet and Exercise

Obesity is increasingly becoming a concern in Zimbabwe as is the reduction in physical activity. Correspondingly with other developing countries, eating habits are changing. This is seen as a shift from natural, traditional wholesome foods to a more Westernized diet low in fibre, high in fat and less of plant protein. The message of losing weight and exercising to help reduce the risk of developing cancer is promoted through various media.

Occupational and Environmental Exposure

In Zimbabwe, lessons are being drawn from industrialized countries in identifying and assessing existing and potential occupational exposures that can lead to the development of cancer in workers and in the community. Therefore, measures to ensure reduction of such exposure are important. Surveillance of workers who are potentially exposed is promoted. There is existing legislation on exposure to the majority of occupational carcinogens. This includes the following acts of Parliament: Pneumoconiosis Act, Radiation Protection Act and Environmental Management Act.

Infections

Infectious risk factors associated with cancer in Zimbabwe include HIV, HPV, Hepatitis B and C, EBV, Helicobacter Pylori and Schistosomiasis. Promotion of interventions such as safe sex, eradication of the Schistosoma parasite and hepatitis B vaccination are part of measures being taken to combat these factors.

Many programmes are in place aiming at reduction in HIV transmission through promotion of general behavioural change, condom use, access to treatment and prevention of mother to child transmission. This has reduced HIV prevalence from about 24% to 15%.

HPV vaccination was approved in 2009 and supported by the Global Alliance on Vaccines and Immunisation (GAVI), which requires sharing ability to treatment and prevention of mother to child transmission. This has reduced HIV prevalence from about 24% to 15%.

Chronic infection with hepatitis B and C causes hepatocellular carcinoma which was responsible for 6% of all cancer deaths in 2011 in Zimbabwe. In 1999, MOHCC reintroduced HBV vaccination targeting children less than 5 years. Since 2007, the HBV vaccine has been administered in combination with diphtheria, pertussis, tetanus and haemophilus influenza type B as a 5 in 1 vaccine (Pentavalent) under the extended program of immunization. A good coverage of 87% was reported as achieved in 2010.

Exposure to ultraviolet radiations is responsible for the development of both melanoma and non-melanoma skin cancers. This is very important in a tropical country with a significant non-black population such as Zimbabwe. Non-melanoma skin cancer prevalence is over 40% of all cancers in both non-black men and women Zimbabweans. Education in avoiding sun exposure especially at peak intensity is given to the white skinned and albino populations. Also, use of protective clothing and sunscreen lotions is promoted for populations at risk. The cost of these lotions can however be prohibitive for daily use.

Cervical Cancer

Visual Inspection with Acetic Acid (VIA) was pioneered by a team of researchers from the Department of Obstetrics and Gynaecology, University of Zimbabwe, in collaboration with researchers from Johns Hopkins Programme for International Education in Gynaecology and Obstetrics (JHPIEGO). They demonstrated in a randomized controlled trial that cryotherapy was a reasonable option to treat cervical intraepithelial neoplasia (CIN) compared to loop excision (LEEP). The former has been the preferred method of screening for cervical cancer in Zimbabwe since.

Demonstration projects with VIA and treatment with cryotherapy were successfully launched by UZ researchers in Mutoko, Gwanda and Chiredzi and they were based on the “see and treat” principle. To date, the government has 66 sites providing VIA visual inspection with acetic acid and cervicography. Several non-governmental organizations also provide a number of sites for VIA with most of these services being centralized in urban areas.

PAP smears are available in private institutions but the cost is prohibitive for the majority of patients. Even among those who can afford them, there has been insufficient awareness campaigns to encourage people to be screened. PAP smear services are generally centralized and not available to the majority population. Most medical insurers do not provide cover for screening services.

Chapter 16 - Zimbabwe
Other Cancers

Only ad hoc screening measures are available for all other cancers. For prostate cancer, digital rectal examination (DRE) is not routinely proposed by the majority of health workers and most public hospitals do not provide PSA screening, although the latter is sometimes offered at awareness events throughout the country.

The situation is similar for other cancers such as colon cancer. The main problems are the recognition of the prohibitive costs of screening services, the absence of an effective national mechanism to motivate, organize and co-ordinate cancer screening activities and also, the absence of a referral system to centres with capacity to take up the cases as they are identified.

Palliative Care

Palliative care and rehabilitation are well-recognized as essential elements in the continuum of care for cancer patients in Zimbabwe. While some elements of both adult and paediatric palliative care have been implemented as part of medical and household interventions for patients, palliative care was formally introduced in 1979. This has contributed significantly to the improvement of the quality of life for patients and family members facing the diagnosis of cancer and other life-threatening or life-limiting illnesses.

Zimbabwe has a long history of providing palliative care, with Island Hospice Service being one of the first hospice organizations to provide hospice and palliative care not only in Zimbabwe but in Africa, since 1979. The service has grown and 17 regional branches were established throughout the country by 1997. Approximately 13 organizations were providing palliative care by 2004.

This growth in palliative care provision has been a result of several initiatives and factors that have necessitated and facilitated the provision of palliative care in Zimbabwe. Initially, a small minority of the population generally accessed palliative care services and the disease focus was cancer. However, with the growth of the disease burden due to HIV and AIDS, palliative care provision has widened to include those living with and experiencing HIV and AIDS and other chronic illnesses.

The result was the increase of community-based services throughout the country provided by both hospice organizations and community home-based care organizations. The community and home-based care programme national review of 2006 reported that there was at least one community and home-based care programme in each of the 62 districts of Zimbabwe.

Notable initiatives have facilitated palliative care service provision in the country. In 1992, the MOHCW established the Prevention and Control of Cancer Committee in Zimbabwe comprising relevant stakeholders and professionals. The committee oversees the development of a ten-year plan for the National Cancer Control Programme for Zimbabwe (1994-2004) with the overall aim to formulate, plan and implement a coordinated and cost-effective programme for the prevention and control of cancer in Zimbabwe. Aspects of palliative care policy were incorporated in this plan.

Within this period the post of a Programme Officer for Cancer and Palliative Care was filled in 1994, funded by the World Health Organization (WHO). Palliative care training was established in the eight provinces and the two cities of Harare and Bulawayo during the same period. However, due to lack of funds coupled with the economic challenges, the programme was not sustained. In 1999, a national Hospice and Palliative Care Association of Zimbabwe (HOSPAZ) was registered to support and promote palliative care services in collaboration with the MOHCW.
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Zimbabwe: Cervical Cancer Trends

As with other preventable cancers, a call to identify and implement preventive measures for HIV-related cancers is important. Within the Zimbabwe National Strategic Plan 2010-2015, several HIV prevention strategies have been adopted. The focus is on promoting safer sexual behaviour and on a package of health sector interventions such as PMTCT, HIV testing and counselling. HIV prevalence has declined over the past decade from 29.3% (1998) to 15.6% (2007). Such measures will also have an impact on the reduction in transmission of the human papilloma virus (HPV) and will add to the control of other cancers such as cervical cancer.

Male voluntary circumcision is another measure that has been adopted in Zimbabwe. Randomised controlled trials from Uganda, Kenya and South Africa demonstrated a reduction in the risk of female to male transmission of HIV with this practice. Additionally, studies have shown that male circumcision also reduces the chances of occurrence of penile cancer and cervical cancer. It is estimated that around 11% of Zimbabwean men are circumcised. It is undertaken for religious reasons among Chewa and Muslims, for cultural reason in other groups such as Xhosa, Tonga or Binga but also for medical reasons.

Unfortunately this is not the case with cervical cancer as shown in Figure 12. However, a shift has been observed in the case of Kaposi’s Sarcoma. In black men, Kaposi’s Sarcoma was the most prevalent cancer (23.8%) and second most prevalent in women (7.1%) in 2006. A decline to 14.8% (second in prevalence) in black men and only 6.9% (third in prevalence) in black women has been observed by 2013.
Education of Cancer Care Professionals (Human Resource Development)

It has been through efforts in human resource development of cancer care professionals that the effect of migration of skills has been cushioned. Training of Radiation Oncologists, Radiographers and recently Medical Physicists and Oncology Nurses is available in Zimbabwe. The postgraduate training of Radiation Oncologists (MMed Rad & Oncs) and other specialties that are essential for a robust multidisciplinary approach to cancer management e.g. various surgery disciplines, pathology, internal medicine, gynaecology is done by the University of Zimbabwe - College of Health Sciences (UZ-CHS). Radiation oncology training was set up in the early 90s through a WHO funded regional initiative. The UZ-CHS also offers undergraduate programs Diagnostic and Therapy Radiography (BSc Hons.).

The School of Radiography is an Associate College of UZ-CHS and offers Radiography training at diploma level within the same teaching hospital. Oncology nursing is facilitated by the School of Nursing. These 2 schools are run by the MOHCC.

The training of Medical Physicists was commenced in 2015 at the National University of Science and Technology.

The School of Radiography is an Associate College of UZ-CHS and offers Radiography training at diploma level within the same teaching hospital. Oncology nursing is facilitated by the School of Nursing. These 2 schools are run by the MOHCC.

The Cancer Community

There are a number of local voluntary organizations that are involved in cancer efforts in Zimbabwe. These include The Cancer Association of Zimbabwe, KIZDCAI, Island Hospice, National Cancer Alliance of Zimbabwe, Brain Tumour Association and Breast Cancer Alliance of Zimbabwe. They complement government efforts in cancer prevention and early detection through advocacy and health promotion.

References

WHO. A Community Health Approach To Palliative Care for HIV and AIDS in Sub-Saharan Africa. Zimbabwe National Statistics Agency (ZNSTAT).


WHO. A Community Health Approach To Palliative Care for HIV and AIDS in Sub-Saharan Africa. Zimbabwe National Statistics Agency (ZNSTAT).

Northern Africa

North African countries bordering the Mediterranean (Morocco, Algeria, Tunisia, Libya and Egypt) have a combined population of around 190 million. Between 3.8% (of the population of Tunisia) and one third (of the population of Libya) live below the poverty level: the other countries are around 20%. Where data are available, the percentage of GDP spent on Health is low (less than 5%).

Life expectancy figures generally do not differ so much from the figures in more developed parts of the world in contrast to the lower life expectancy figures in the other African regions and Tunisia has the highest, Sudan has the lowest life expectancies at birth in Northern Africa (Figure 14.3.1 on the next page) (World Health Statistics, 2009).

Over the last few years, Cancer Registries in North Africa (Morocco, Algeria, Tunisia, Libya and Egypt) have increased in number from one (Morocco) to nine (Morocco: Rabat, Casablanca; Algeria: Alger; Senegal: Tunisia: Northern Tunisia, Sousse (Centre), Sfax (south); Libya: Benghazi; Egypt: Gharbia, Awaan, Mina, Dameta) and currently covers 15% of the total regional population and are producing quite good, acceptable quality, according to available indicators (American Cancer Society, 2011; Anetzi et al, 2010; Taj, Benjaafar and El-Raki, 2005; Bendi et al, 2004; Hamdi Chérif et al, 2008; Parkin et al, 2005; Institut National de Santé Publique Registre des Tumeurs d’Alger, 2006; Ben Abdallah et al, 2006; Korbi et al, 2008; Souani et al, 2007; El Mouttali et al, 2004; El Mouttali et al, 2008; Amal et al, 2008; El Mouttali et al, 2007; Inaizam and Miahit, 2010; Seif Eddin et al, 2007; Barchana et al, 2009; Registre des Cancers de la Région du Grand Casablanca, 2007; Taj, El-Raki and Benjaafar, 2011; Issaoua et al, 2010).

These quite reliable data made it possible to prepare this section. There are some other registries also in the region with less reliable data, i.e. Oran Cancer Registry in Algeria. Two reports prepared using data of different years (1998-2005 and 2006) which has released from this registry contain contradictory results (i.e. lung cancer AARs (Age adjusted incidence rate on World Standard population) in men 21.4 and 6.8 in 1995-2005 and 2006 reports respectively) (Fouath et al, 2008; Ferlay et al, 2010). The figures considered as less reliable were not used in this chapter.

Despite the reported relatively low incidence and mortality rates at present in Africa, the cancer burden is projected to almost double in coming decades due to the aging and population growth. Furthermore it seems likely that the cancer burden will be even higher because of the
changes of behaviours and lifestyles in the region towards more risky ones associated with economic development, such as smoking, unhealthy diet and less physical activity (American Cancer Society, 2010).

In consequence of the differences in exposure to the most common risk factors, diagnostic possibilities (lack of diagnostic and screening services), public awareness of early signs and symptoms, and availability of treatment, not only the incidence, mortality and survival rates but type of major cancers and stage at diagnosis as well in Africa, vary significantly from that in developed parts of the world. For instance, the infection related cancers such as Kaposi’s Sarcoma, liver, cervical cancers dominate the patterns while cancers such as lung, breast and colorectal cancers associated with behaviours related with economical development (i.e. smoking, less activity, obesity) or cancers like prostate cancer related with overdiagnosis have lower incidence rates than shown in the developed populations.

It looks like the differences between Africa and the developed world in cancer incidence and mortality patterns actualize also across regions within Africa depending on the regional differences in socioeconomic, cultural and other environmental factors that effect the exposure levels to the known risk factors (American Cancer Society, 2010).

In Northern Africa in both sexes, cancer pattern by type of major cancers resembles to the pattern in developed world with only remarkable exceptions of colorectal cancers with low frequency and liver cancer with high incidence rates, rather than that in the rest of Africa where infection-related cancers are the most frequent. The commonest cancers are lung, liver, bladder, colorectal, NHL (Non-Hodgkin Lymphoma), leukemia, and prostate cancers in men; breast, uterine cervix, colorectal, NHL, liver, thyroid and ovary cancers in women (Figures 14.3.2 & 14.3.3, Tables 14.3.1 & 14.3.2).

### Estimated Age-standardized Incidence and Mortality Rates

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Incidence ASR (W) rate per 100,000</th>
<th>Mortality ASR (W) rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>Bladder</td>
<td>200</td>
<td>20</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>300</td>
<td>30</td>
</tr>
<tr>
<td>Prostate</td>
<td>400</td>
<td>40</td>
</tr>
<tr>
<td>Liver</td>
<td>500</td>
<td>50</td>
</tr>
<tr>
<td>Colorectum</td>
<td>600</td>
<td>60</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>700</td>
<td>70</td>
</tr>
<tr>
<td>Larynx</td>
<td>800</td>
<td>80</td>
</tr>
<tr>
<td>Stomach</td>
<td>900</td>
<td>90</td>
</tr>
<tr>
<td>Brain, nervous system</td>
<td>1000</td>
<td>100</td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>1100</td>
<td>110</td>
</tr>
<tr>
<td>Lip, oral cavity</td>
<td>1200</td>
<td>120</td>
</tr>
<tr>
<td>Pancreas</td>
<td>1300</td>
<td>130</td>
</tr>
<tr>
<td>Genital organs</td>
<td>1400</td>
<td>140</td>
</tr>
</tbody>
</table>


### Estimated Age-standardized Incidence and Mortality Rates: men

![Figure 2: Estimated age-standardized incidence and mortality rates: men](image-url)

### Estimated Age-standardized Incidence and Mortality Rates: women

![Figure 2: Estimated age-standardized incidence and mortality rates: women](image-url)
### Table 1: Estimated incidence, mortality and 5-year prevalence: men

<table>
<thead>
<tr>
<th>Cancer</th>
<th>Incidence (%)</th>
<th>Mortality (%)</th>
<th>5-year Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lip and oral cavity</td>
<td>2.7</td>
<td>2.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>1.1</td>
<td>0.9</td>
<td>1</td>
</tr>
<tr>
<td>Other pharynx</td>
<td>0.9</td>
<td>0.4</td>
<td>0.9</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>1.3</td>
<td>1.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Oesophagus</td>
<td>0.7</td>
<td>0.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Stomach</td>
<td>2.6</td>
<td>2.5</td>
<td>2.3</td>
</tr>
<tr>
<td>Colon</td>
<td>4.3</td>
<td>4.2</td>
<td>4.3</td>
</tr>
<tr>
<td>Cancer of liver</td>
<td>1.6</td>
<td>1.6</td>
<td>1.7</td>
</tr>
<tr>
<td>Bone</td>
<td>1.3</td>
<td>1.3</td>
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</tr>
<tr>
<td>Lung</td>
<td>1.3</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Bladder</td>
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<td>1.2</td>
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</tr>
<tr>
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<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Brain, nervous system</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Hodgkin lymphoma</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>2.6</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Multiple myeloma</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>All cancers excl. non-melanoma skin cancer</td>
<td>10.1</td>
<td>10.1</td>
<td>10.1</td>
</tr>
</tbody>
</table>

Incidence and mortality data for all ages; 5-year prevalence for adult population only

ASR (W) and proportions per 100,000

### Table 2: Estimated age-standardized incidence and mortality rates: women

<table>
<thead>
<tr>
<th>Cancer</th>
<th>Incidence (%)</th>
<th>Mortality (%)</th>
<th>5-year Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lip and oral cavity</td>
<td>1.6</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Oesophagus</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>Stomach</td>
<td>3.7</td>
<td>3.7</td>
<td>3.7</td>
</tr>
<tr>
<td>Colon</td>
<td>6.6</td>
<td>6.6</td>
<td>6.6</td>
</tr>
<tr>
<td>Cancer of liver</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Bone</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Lung</td>
<td>2.3</td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Bladder</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Kidney</td>
<td>1.7</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Brain, nervous system</td>
<td>1.7</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Hodgkin lymphoma</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>5.5</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Multiple myeloma</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>All cancers excl. non-melanoma skin cancer</td>
<td>9.9</td>
<td>9.9</td>
<td>9.9</td>
</tr>
</tbody>
</table>

Incidence and mortality data for all ages, 5-year prevalence for adult population only

ASR (W) and proportions per 100,000

In men, lung cancer was the most commonly diagnosed and the leading cause of cancer deaths according to GloboCancer 2008 estimates in the region. However with the observed significant increase in incidence and mortality of liver cancer, particularly in Egypt based on data from Garbash registry (Amal et al, 2008; Seif Eldein et al, 2007), it can be expected that the liver is the most common cancer site in the present. Chronic infections with hepatitis C virus (HCV) in Northern Africa are the major causes of liver cancer. Schistosoma is a prevalent parasite (blood fluke) in the region which caused chronic liver disease and bladder cancer especially during 1960s, 1970s mainly in Egypt. As a result of HCV contaminated injection equipment during mass treatment campaigns against Schistosoma, HCV associated liver cancer has become the major cancer in Egypt. Bladder cancer is one of the common cancers in the region. Egyptian men have had the highest bladder cancer incidence rates worldwide (Parkin

In men, lung cancer was the most commonly diagnosed and the leading cause of cancer deaths according to GloboCancer 2008 estimates in the region. However with the observed significant increase in incidence and mortality of liver cancer, particularly in Egypt based on data from Garbash registry (Amal et al, 2008; Seif Eldein et al, 2007), it can be expected that the liver is the most common cancer site in the present. Chronic infections with hepatitis C virus (HCV) in Northern Africa are the major causes of liver cancer. Schistosoma is a prevalent parasite (blood fluke) in the region which caused chronic liver disease and bladder cancer especially during 1960s, 1970s mainly in Egypt. As a result of HCV contaminated injection equipment during mass treatment campaigns against Schistosoma, HCV associated liver cancer has become the major cancer in Egypt. Bladder cancer is one of the common cancers in the region. Egyptian men have had the highest bladder cancer incidence rates worldwide (Parkin.
et al, 2005). Bladder cancer is caused by smoking and occupational chemical exposure in Schistosoma-free regions, i.e. developed countries, while about 40% of the disease in most parts of Africa is caused by Schistosoma haematobium.

The incidence and mortality rates of Kaposi's Sarcoma (an HIV-associated cancer caused by human herpes virus) in Northern Africa are 20 times lower than in Eastern Africa due to the lower HIV/AIDS prevalence (Paik et al, 2005).

In women, breast cancer is the most frequent cancer and the leading cause of cancer death among women in the region. Based on data from the Algeria (Setif) cancer registry, breast cancer incidence rates have nearly doubled over the past 20 years, though the rates still remain about one-fifth those in the Western countries (El Minira et al, 2007; Ibrahim and Mahalal, 2010). Cancer of the cervix is the second most common diagnosed and second leading cause of cancer death in the Northern Africa in contrast to Eastern Africa where cervical cancer is the most common and leading cause of cancer with very high incidence and mortality rates due to the high prevalence human papillomavirus (HPV) infection and lack of Pap test screening services for prevention and early detection of the disease (Parkin et al, 2005).

The cancer pattern does not show substantial diversity across the region among the countries. Across the North African Region, breast cancer is the most common cancer and leading cause of cancer deaths among women. In men, lung is the commonest cancer in Algeria, Libya, Morocco and Tunisia while liver in Egypt and ML in Sudan are the most frequent diagnosed cancers (Table 14.3.3). The distribution of the different cancer sites seems quite homogeneous across the region, with a few exceptions (Tables 14.3.4a and 14.3.4b):

- High level of liver and bladder cancer incidence in Egyptian men (particularly in Gharbiah)
- High rates of non-Hodgkin lymphomas in both sexes in Gharbiah, Egypt
- High level of nasopharynx cancer incidence in Egyptian men (particularly in Gharbiah)
- High rates of non-Hodgkin lymphomas in both sexes in Gharbiah, Egypt
- High breast cancer incidence rates in women in Algeria and Aiwan
- High rates of cervical cancer in the west of the region, namely in Algeria and Morocco

Lower incidence rates of nasopharyngeal cancers in both sexes in Egypt. The rates of nasopharyngeal cancer are intermediately high in all the North African countries (but Egypt), compared to those observed in developed countries. Nasopharyngeal carcinoma has a strong relation with Epstein-Barr virus primarily in endemic regions.

Table 3: Most frequent cancer sites by gender in Northern African countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Egypt</td>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Libya</td>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Morocco</td>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Tunisia</td>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Algeria</td>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Egypt</td>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Libya</td>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Morocco</td>
<td>Lung</td>
<td>Breast</td>
</tr>
<tr>
<td>Tunisia</td>
<td>Lung</td>
<td>Breast</td>
</tr>
</tbody>
</table>

Table 6: Incidence rates (per 100,000 age-standardized on world population) of major cancers in the regions of North African Registries, Men

<table>
<thead>
<tr>
<th>Region</th>
<th>Colorectum</th>
<th>Liver</th>
<th>Lung</th>
<th>Bladder</th>
<th>Breast</th>
<th>NHL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria (1988-2000)</td>
<td>19.9</td>
<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Egypt (1988-2000)</td>
<td>19.9</td>
<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
<tr>
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<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Morocco (1988-2000)</td>
<td>19.9</td>
<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Tunisia (1988-2000)</td>
<td>19.9</td>
<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Table 5: Incidence rates (per 100,000 age-standardized on world population) of major cancers in the regions of North African Registries, Women

<table>
<thead>
<tr>
<th>Region</th>
<th>Colorectum</th>
<th>Liver</th>
<th>Lung</th>
<th>Bladder</th>
<th>Breast</th>
<th>NHL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria (1988-2000)</td>
<td>19.9</td>
<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Egypt (1988-2000)</td>
<td>19.9</td>
<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Libya (1988-2000)</td>
<td>19.9</td>
<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Morocco (1988-2000)</td>
<td>19.9</td>
<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Tunisia (1988-2000)</td>
<td>19.9</td>
<td>7.5</td>
<td>1.1</td>
<td>6.1</td>
<td>18.8</td>
<td>1.7</td>
</tr>
</tbody>
</table>

* All sites including CH4 is not available at the source. ** 1998-2002 *** 1993-97
The African population is growing faster than that of any other continent. It is set to double by 2050, when it is estimated to comprise 24% of the world’s population. By the end of the century, it will nearly quadruple and it is estimated that 40 percent of the world’s population will be from Africa.

(Parkin et al, 2014)
The prevalence of cancer is higher in low and middle income countries (60%) compared to high income countries and these figures are projected to rise by over 75% by the year 2030 unless intervention is done. In some low income countries, the rise may be by 93% (Bray et al, 2012; de Martel et al, 2012; Parkin et al, 2014).

Kenya, like most other developing countries is undergoing an epidemiologic shift of disease patterns characterized by increasing prevalence of cancer and other Non-Communicable diseases and a double strain on health care resources. As shown in Figure 1, these emerging lifestyle and genetic diseases previously associated with high income countries are not replacing infectious diseases but adding to them (Ministries of Medical Service, 2011; Mutuma GZ, 2006). Cancer is ranked third among causes of death in Kenya, after infectious and cardiovascular diseases. The annual incidence is about 28,000 cases with mortality estimated at 22,000 cases (Etyang et al, 2014). Data from the Kenyan Ministry of Health projects that by the year 2025, NCDs will overtake infectious diseases as shown in Figure 1.

Data from the Kenyan Ministry of Health projects that by the year 2025, NCDs will overtake infectious diseases.
We describe development of a cancer control and prevention program at Moi Teaching and Referral Hospital (MTRH) /Moi University, leveraging the infrastructure initiated by the Academic Model Providing Access to Health care (AMPATH) Program for treatment of HIV/AIDS.

What is AMPATH?

The acronym AMPATH was initially derived from the Academic Model for the Prevention and Treatment of HIV/AIDS (Einterz et al, 2007). As the name indicates, the initial goal of the program was provision of HIV care at a time when the epidemic was at its peak but hardly any care existed. The program was initiated in 2001 as a partnership between Moi University School of Medicine, Indiana University School of Medicine, and Moi Teaching and Referral Hospital (American Cancer Society, 2010). Moi Teaching and Referral Hospital (MTRH) is the second largest Public Hospital in Kenya serving the entire western Kenya where about 50% of Kenya’s population live. Over the years, AMPATH has expanded to include primary health care and chronic disease management including cancer. AMPATH currently treats over 140,000 patients for HIV in 60 Government of Kenya’s Ministry of Health facilities in western Kenya as shown in Figure 2. In addition to HIV care, AMPATH educates orphaned children and partners with volunteer lawyers and other legal experts to provide free legal services to HIV-positive patients. All AMPATH programs are initiated and led by Kenyans in a collaborative partnership.

To achieve sustainability, AMPATH has enrolled over 10,000 patients in income security programs including Agricultural extension services, micro-finance and small business initiatives. In partnership with the UN Food Program, it feeds 31,000 patients daily. Once an AMPATH nutritionist finds that a patient is food insecure, they are provided with a nutrition prescription assuring access to 50% of daily nutrition requirements for themselves and their dependents for up to 1 year or until they regain their strength to provide for themselves. To ensure sustainability, patients are trained on profitable farming techniques on their farms. Successful farmers are contracted by AMPATH to sell food to the nearby AMPATH clients with vouchers.

To encourage patients to raise capital, Project officers initiate the creation of self-regulating savings groups. Groups are made up of 15 - 30 self-selected members who meet regularly and save money through the purchase of shares which form a loan fund. At the formation stage of the group, members are expected to draft a Group Constitution that stipulates group regulations and mandates operational structures of the group. The groups issue loans to members with a 10% interest rate. Income is also generated from fines paid by members due to lateness for meetings or loan re-payment. At the end of one cycle (12 months), each member is refunded their shares, and interest earned from loans is divided among the

Figure 1: Mortality trends in Kenya

Source: Ministries of Medical Service, Public Health and Sanitation, Comprehensive National Health Policy Framework, 2011

Figure 2: AMPATH sites

Source: AMPATH

Figure 2: AMPATH sites

Source: AMPATH

Figure 1: Mortality trends in Kenya

Source: Ministries of Medical Service, Public Health and Sanitation, Comprehensive National Health Policy Framework, 2011
3.2. Organization

In 2008, the service was upgraded to a formal department of Haematology and Oncology by MTRH and elevated into a full division in 2012. The AMPATH-Oncology Institute (AOI) was formed in hopes of creating a sustainable means to providing access to safe drinking water in resource-constrained settings.

The AOI has three Clinical Pillars:

1. Screening and Prevention – Identification of at-risk populations, active reduction of risk through screening and early intervention will be the focus of this theme. Approaches include implementation of screening and prevention programs in both adult (e.g. cervical and breast cancer) and paediatric populations (e.g. retinoblastoma screening). Key elements include building a screening and early detection infrastructure, immunization as well as education of practitioners and at-risk populations.

2. Diagnosis and Treatment – this clinical pillar is potentially the most expansive, and covers coordination of clinical care services to establish a standard for oncology care, and to create a research engine that is capable of redefining that standard regularly. Currently, the AOI prioritizes diagnosis and treatment programmes by those diseases with the highest impact on quality of life and lost life-years.

3. Palliative Care – with the majority of patients presenting with very late-stage disease, a major focus of this pillar is the expansion of an effective palliative care and home hospice program.

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For each of these Clinical Pillars, there is substantial need for resources and intellectual effort to create a sustainable organization for the development of a premier cancer program in sub-Saharan Africa. To focus upon construction of this effort, the following cross-cutting areas direct the development of the AOI:

- **Care delivery** - Chemistry and other medical supplies, pathology support (immunohistochemistry stains, microscopes), imaging (CT scans, mammography, and ultrasound), transportation and temporary housing are required to enable delivery of care for patients from a wide catchment area.

- **Physical infrastructure** - The development of the physical infrastructure is needed for the AOI to adequately deliver the care and to address the clinical mission. This includes the outpatient (for screening, prevention and treatment (chemotherapy and radiation therapy!)) and inpatient facilities. The new outpatient facility was opened in 2015. An improved and dedicated inpatient ward is almost complete for optimal treatment of adult cancer populations. Paediatrics is still housed in the general paediatrics hospital buildings.

- **Human capital** - Expansion of the personnel with specialized education is required to adequately deliver care. Curriculum has been developed for various programs. Our focus is towards the development and the training of medical, radiation, and surgical oncologists; nurses; pathologists; and support staff for optimizing health care delivery and research in limited resource settings.

- **Research** - The research and educational infrastructure must focus on relevant clinical, translational and population research to impact and optimize health care delivery. This includes training opportunities in clinical research trials with opportunities for pilot projects relevant to the population in the catchment area of western Kenya. This is also pursued by AMPATH Oncology Institute.

- **Medical informatics** - Informatics infrastructure is under development to support both the clinical and research missions of AOI including an annotated tumour registry.

- **Patient advocacy and education** - The stigma and myths about cancer and the futility of treatment abound. Development of an active patient advocacy program that can assist in the dissemination of knowledge throughout the catchment area is required. Patient support groups for breast cancer and colorectal cancers has been established.
The AMPATH Oncology Institute (AOI) relies on limited intra-institute services and personnel and extensive coordination with existing AMPATH, and de facto, Moi Teaching and Referral Hospital/Moi University, clinical services and core facilities. At present there are 6 clinical services within the AOI – four of which are already well established cancer programs (Medical Oncology, Pediatric Oncology, Gynecology Oncology, and Screening Services). Surgical and Radiation Oncologic services are developing programs. There is some overlap between the clinical services – for example, screening services would be informed by both Gynaecology Oncology (cervical cancer), Medical Oncology (breast cancer), and Pediatric Oncology (retinoblastoma).

The AOI has additional Core Services, shared by the Clinical Services, including: the Oncology Pharmacy, Pathology and Cancer registry, Data and Clinical Trials management, Nutrition, Oncology Nursing, and Radiotherapy. The Oncology Pharmacy has also been well established as a functional Chemotherapy Service and Dispensing Pharmacy; the capacity as a Research Pharmacy is growing with current focus on pharmacovigilance. A number of other services exist in which the AMPATH Oncology Institute will need to coordinate for the delivery of clinical care as well as research. This will help to streamline the interface between the AOI and the broader AMPATH supported resources and core facilities minimizing redundancy and maximizing efficiency.

Public-Private Partnerships

The support of key donors has to date allowed a dramatic expansion of services through AMPATH Oncology. Nearly 10,000 patient visits to AMPATH Oncology occur each year with approximately 10-12,000 women also being screened for breast and 20,000 for cervical cancers annually. The AOI has been highlighted by the NCI Centre for Global Health (NCI Center for Global Health, 2015) and has been recognized as the model for comprehensive cancer care in low to middle income countries as highlighted by Dr. Peter Boyle and the International Prevention Research Institute (Conversation with The Cancer Letter, 2014; The State of Oncology, 2013). AMPATH has been the site for three consecutive ASCO Multidisciplinary Care Management Conferences in 2012, 2013 and 2016, and NCI Grant Writing Workshop in 2013. This underscores the tremendous return on investment created by the support of industrial partners and other philanthropists. We will continue to work with these and other international partners to provide funding for patient care costs and working with the Kenyan Ministry of Health to provide more sustainable support through insurance plans for cancer patients in Kenya. Towards this end, the National hospital insurance fund (NHIF), has in 2016, started re-imbursement of cancer services especially chemotherapy treatments for up to USD 250 per cycle. This is augurs well for the sustainability of our programs.

Organizational Structure of AOI

Functionally, the top level of organization of the AOI is the Steering Committee comprised of representatives from Kenya and the North America/ European Partners. Field operations are headed by the Co-Directors (Drs. Chite Asirwa (Indiana University Simon Cancer Centre), Busakhala (MTRH) and Omenge (MTRH)) on ground in Kenya. The Co-Directors have the ultimate responsibility of both implementing the multi-year plan, as well as reporting on progress and difficulties to the Steering Committee. Additionally, the Co-Directors are responsible for the interface with other AMPATH, MTRH and Moi University organizational entities.

Leadership of AOI

Administration and oversight is provided by the AOI steering committee which is composed of representatives from collaborating institutions. The steering committee holds monthly teleconferences and communicates continuously through email. Departmental heads submit monthly reports to the two Co-Directors who present them to the steering committee.

The steering committee also works through sub-committees which hold additional monthly teleconferences. These include the Finance committee, Research Working group, Radiation Oncology working group and Paediatric Oncology working group.
By 2014, AOI had treated over 5,000 patients and screened over 30,000 people for cancer.

Strategic Planning

All aspects of the program are protocol-based with intense programmatic monitoring and evaluation, allowing rapid response to the changing needs of our patient population. The program has had approximately 20% annual growth for the last several years (refer to Figure 4 and 5). We expect to continue to grow minimally at this rate, and so expect the need for, and cost of, chemotherapy to rise proportionally. We have balanced sustainability of service provision and access to services through provision of chemotherapy to patients at cost and a credit system for patients who cannot afford chemotherapy. The money is managed by the AMPATH Research and Sponsored Projects Office (RSPO).

We have successfully contained costs through several processes:

- Care Rationing – based on expert opinion, cancer presentations in Kenya were divided into low priority diseases, medium priority diseases, and high priority diseases, based on expected response rates, expected benefit, and volume of patients seen with that presentation.
- Protocol-based Therapy – based on expert opinion and literature review, all chemotherapy to be purchased and offered through AOI are developed in consultation, based on the market-cost of drugs, local availability of drugs, and expected benefits.
- Bulk purchasing - the department has been able to project needs, and make bulk quarterly purchases based on predicted needs.
- Integration of Haematology and Oncology services
• Weekly tumour boards and multi-disciplinary clinics where clinicians discuss and adapt accessible standard practice.

• Active participation in Clinical trials and research which allows participants to receive study provided treatment.

• Task-Shifting where general nurses and clinical officers are trained to perform specialized oncology duties.

• Promoting enrolment in the National Health Insurance Scheme (NHIF). NHIF is a state corporation that recently extended insurance cover to cancer.

**Training**

Through AOI, curriculum developments and establishment of training programs has been done for Medical Oncologists, Gynaecology Oncologists, radiation oncologists, radiotherapy technicians, Oncology clinical officers and a radiation physicist. In addition, curriculum for Medical Oncology is at advanced stages of approval in Moi University. Nursing Oncology training begins later this year.

**Challenges**

• Lack of local research funding

• High rates of loss-to-follow up of Patients making it difficult to have accurate treatment outcomes data.

• Lack of radiation services

• Donor dependency

• Lack of training facilities

**Lessons learned**

1. Once Cancer services are established, they attract both governmental and non-governmental support

2. Integration of cancer services with existing infrastructure should be done where possible. Some Professional bodies now provide guidelines based on available resources (American Cancer Society, 2010; Farmer et al, 2010; Kerr et al, 2010).

3. Research is important in addition to provision of care.

4. Collaborative networks are vital for provision of cancer services

**References**


Ministries of Medical Service PHaS. Comprehensive National Health Policy Framework. 2011.


Levels of knowledge about the magnitude of the cancer burden remain inadequate in most countries in Africa.

Miriam Schneidman, Joanne Jeffers, Kalina Duncan
in the CCC SSKE because they are each at a different stage in the development and implementation of CCC programs, have different strengths, and have much to learn from one another’s experiences.

**Effective Cancer Care and Control Interventions**

Comprehensive CCC programs provide a range of services that meet the evolving needs of patients along the cancer continuum, from prevention to treatment to palliative care, as noted below.

- **Primary Prevention** - HPV and Hep B vaccination campaigns; behaviour change campaigns to promote healthy lifestyles; anti-tobacco and no smoking campaigns; and “sin” taxes to curb tobacco and alcohol use

- **Secondary Prevention (screening)** - information and education campaigns to encourage breast and cervical cancer screening; cytology (Pap) screening; visual inspection with acetic acid (VIA); and HPV DNA testing.

- **Secondary Prevention (treatment)** - increased access to cryotherapy, loop electrosurgical excision procedure (LEEP), and cone biopsy.

- **Cancer Treatment** - provision of specialized care for early and late stage treatment, including standard surgical techniques, radiation, and chemotherapy.

- **Palliative Care** - palliative, home based or institutional care programs and expanded access to opioids and radiation.

Effective systematic implementation of these interventions requires a health system in which surgery, radiotherapy, chemotherapy, and pain management are well integrated at both clinical and community levels. Virtually no country in Africa, save South Africa, has capacity at all these levels. However, several have initiated promising programs to address selective aspects that were covered during the CCC SSKE.

Intervening early in the continuum of care will save lives and resources. There is growing evidence that many of the interventions in the continuum of care are cost effective. Immunization with the HPV vaccine and cervical cancer screening can reduce deaths from cervical cancer by 80 percent. Early stage treatment of most cancers increase long-term survival by 50 percent, and palliative care can reduce suffering of terminally ill patients.

**Common Challenges and Innovative Solutions**

Participants shared innovative approaches to common challenges in the planning, management, implementation, and financing of CCC initiatives. The main themes, key issues, and good practices covered during the CCC SSKE are summarized below.

**Improving Surveillance to Better Understand the Burden of Disease**

Levels of knowledge about the magnitude of the cancer burden remain inadequate in most countries in Africa. Lack of comprehensive, timely data, and information impedes effective program planning and service delivery. Population-based cancer registries (PBCRs) are vital components in comprehensive CCC programs and document the nature and scope of the cancer burden. PBCRs are used to collect data on new cancer cases in geographically defined populations. Planners, policy makers, and researchers use this information to better understand the cancer burden and improve treatment and prevention options.

Uganda has one of the longest standing and most comprehensive population-based cancer registries in Africa. A number of key lessons have emerged, including the importance of:

- Ensuring ongoing political commitment, and mobilizing resources to make population-based cancer registration a key component of the national cancer control program.

- Strengthening data reliability by enhanced data verification; standardization; improved hospital data systems, including electronic patient records; and promotion of new technologies such as smart phones for more rapid data transmission.

- Increasing population coverage to capture data from rural areas with the Kampala Cancer Registry linking its work with four regional cancer registries to expand coverage to almost 30 percent of the population, a representative sample that can be used to estimate the national cancer burden.

**Identifying National Leaders to Champion the Program**

Highly motivated, visible champions can mobilize support and create opportunities for CCC initiatives. The Zambia program received strong political support from former Zambian First Lady Dr. Christine Kaseba-Sata, a gynaecologist by training. Dr. Kaseba-Sata hosted the 6th Stop Cervical Cancer in Africa Conference and generated a great deal of visibility and political support for CCC initiatives in Zambia, as well as throughout Africa. Similarly, the Kenya Cancer Control Program benefited from the support of Ministers of Health who had personal experiences with cancer.

- Identifying champions and influential stakeholders is critical - Key stakeholders need to be mobilized, including Ministries of Health, advocacy groups; cancer survivor and patient support groups; cancer experts; NCD experts; tobacco control experts; and private sector representatives. Additional allies include officials from Ministries of Finance.

**Designing Successful National CCC Plans and Programs**

Cancer planning is critical to obtaining political support, prioritizing and costing key interventions, and identifying opportunities for strategic partnerships. Successful national plans are evidence-based and informed by locally-relevant research; developed in a participatory fashion by a diverse group of stakeholders; comprehensive in nature, with a full range of activities that strengthen prevention, diagnosis, treatment, palliative care and survivorship; and include a strong monitoring and evaluation component. A number of common lessons have emerged from the design and implementation of national cancer plans and programs:

- Creating linkages between cancer-specific programs and broad national health programs at the central, regional and district levels as well as between public and private sectors taps potential synergies and efficiencies - Effective linkages need to be established with sexual and reproductive health, maternal and child health, NCD and HIV/AIDS care and treatment programs. Partnering with the private sector and leveraging their expertise and resources is critical to increasing access and improving quality of care.
• Demonstrating economic impact can facilitate support - Ministries of Health need to make the economic case for investing in cancer, in order to mobilize support and resources.

• Overcoming lack of awareness, stigma, discrimination and denial about cancer is critical to generating broad-based support for the program - While support for CCC initiatives is growing in many countries, as increasingly everyone knows someone who is affected by the disease, much more needs to be done to improve knowledge and awareness and early detection.

Innovative Approaches for Strengthening Cancer Prevention, Early Detection, Diagnosis and Treatment

With the rapidly growing number of cancer cases, many countries have initiated programs to strengthen prevention, promote early detection, and establish capacity to diagnose and treat early stage cancers. The CCM South-South Knowledge Exchange permitted countries to share their individual successes and promising approaches, inspiring each other to expand the range of interventions along the cancer continuum of care. A number of generic lessons and country-specific examples emerged.

• Generating demand for HPV vaccination and cervical cancer screening services is critical to improving uptake of these services and ensuring cases are prevented or found at earlier stages - Countries draw on their national resources and use unique approaches to accomplish this goal in their respective settings. Zambia uses chiefs, churches, traditional marriage counsellors and other community leaders to raise awareness of the importance of HPV vaccination and cancer screening. Botswana uses census data strategically to target program activities, and is in the midst of implementing a national HPV vaccination program. Rwanda has used its extensive network of Community Health Workers (CHWs) to educate women about the importance of cancer screening and improve uptake.

• Raising awareness through innovative social mobilization efforts to reach a younger target population and to overcome misperceptions and traditional beliefs concerning cervical cancer - The Zambia program found that the best advocates are women returning to their communities after receiving care. The program also introduced health clubs at the secondary education level to raise awareness of cervical cancer screening among younger people.

• Using innovative telemedicine and mobile phone communication strategies can increase access to services in sparsely populated areas - One notable example is the innovative use of mobile phone technologies in Zambia to communicate and follow up with patients and of telemedicine to ensure quality of care and accuracy of diagnoses.

• Promoting innovative human resources strategies is key to building capacity and addressing the acute shortages of trained health personnel - Given the acute shortages of qualified oncology specialists it is critical to not only expand training but also identify opportunities for task sharing. Rwanda, Zambia and Botswana have effectively used task sharing to expand the role of nurses in the provision of cervical cancer screening and introduced quality assurance programs, training, and supervision to enhance their performance. Zambia increased its capacity to provide cervical cancer screening by piggybacking upon an existing, well-functioning infectious disease platform.

• Building pathology capacity can serve as an entry point for cancer care - Pathology capacity and manpower is limited but essential for the provision of quality CCC services. In the absence of accurate diagnosis it is difficult to make informed decisions about treatment options. Several countries have now placed emphasis on establishing pathology services. Kenya has equipped pathology labs at selected sites while in Zambia they have leveraged ongoing platforms can generate cost efficiencies and contribute to sustainability - Given both cost and physiological considerations it is sensible to piggyback cancer interventions onto existing primary health or communicable disease platforms that are well established. Zambia has strengthened the sustainability of its cervical cancer screening program by integrating the service into the MCH program of the Ministry of Health. Botswana has also strengthened linkages and leveraged resources from other parts of the health system (e.g. HIV/AIDS program) to enhance chances of sustainability. Similarly, Kenya has built an oncology program from health system infrastructure and specialty care centers originally dedicated to HIV/AIDS.

Increasing Access to Palliative Care (PC)

Access to urgently needed palliative care for terminally ill patients is very limited and constrained by legal, regulatory, and procurement issues. Several countries are beginning to tackle this constraint by:

• Mobilizing both public and private sector support and resources for PC - Kenya has increased access to PC by offering services through a range of public and private sector providers and raising awareness of the importance of PC for all life threatening illnesses.

• Increasing access to cost effective drugs - Rwanda and Uganda procure a more cost effective solution of morphine that is dispensed by trained pharmacists and use public private partnerships to increase access to services.

• Authorizing trained nurses to prescribe and better utilizing pharmacists to dispense opioids - Outdated regulations and practices for procuring and dispensing drugs limit access to PC in most countries. Uganda has authorized trained nurses to prescribe morphine thereby increasing access.

Increasing Access to an Essential Cancer Care Package

While most countries in Africa are focused on designing an essential health care package towards Universal Health Coverage, cancer care and control planners and policymakers have largely not been active partners in this process. To this end, there is a need to...
• Identify the most cost-effective essential cancer care package and determine the cost of its implementation as well as its potential impact - Research conducted under the Disease Control Priorities, Third Edition (DCPs3) has determined that HPV vaccination programs, tobacco control measures and tobacco taxes are cost effective interventions in cancer control in many country contexts. For example, Kenya has implemented tobacco control measures and Rwanda has successfully achieved national coverage of HPV immunization.

• Use economic analyses to make the case for investing in cancer and mobilize additional resources to support cancer interventions - Economic analyses are effective tools for making the economic case to support CCC programs. Several countries (i.e. Ghana and Tanzania) that did not participate in the Knowledge Exchange had valuable experiences with economic analyses to inform public policy. Ghana has conducted a cost effectiveness analysis to determine the most cost effective way of expanding its breast cancer prevention program and is using the results to mobilize national health care resources to expand the program. Tanzania used a WHO toolkit to assess the cost effectiveness of alternative strategies for providing HPV vaccination to young girls. Uganda has recently conducted an economic analysis of their registry with the United States CDC.

Increasing Engagement of the Private Sector, Including through Public Private Partnerships (PPPs)

While governments need to ensure financing of cancer programs, they do not necessarily need to deliver the services. It may be more cost-effective for governments to purchase services from private sector hospitals and clinics through public private partnerships. In countries with a vibrant private sector, the public sector needs to remove barriers that impede private sector provision of cancer care and establish a strong enabling environment; create incentives to encourage private sector provision of cancer care; and explore opportunities to form public private partnerships.

AMPATH Oncology and Chronic Care Program in Kenya is an example of an innovative public private partnership between government agencies, academic institutions and private companies that provides access to cancer care for a population of 18 million. Several key lessons have emerged from the success of AMPATH.

• Public Private Partnerships function best when they have a flexible structure that allows public, private and academic partners to each play to their strength - In the AMPATH PPP, government agencies, at all levels, ensure oversight and stewardship; support research, and provide an enabling environment; academic institutions contribute scientific and research expertise and negotiate agreements; and private organizations provide in-kind resources such as bioassays, targeted funding, and resource personnel.

• Ongoing education of patients, service providers, policymakers and the community is needed to maintain political support for the program; address misconceptions and increase demand for services; and improve understanding of side effects to enhance treatment compliance and improve quality of care - AMPATH conducts community and patient education and supports the formation of patient support groups; conducts continuing education and other forms of multidisciplinary provider training to improve quality of care; disseminates research findings and best practices; and provides technical expertise to the M&E to improve policies, guidelines and treatment protocols.

• Increasing access to cost effective drug supplies is critical to improving affordability and sustainability of services - AMPATH has worked with pharmaceutical companies to access generic drugs at lower prices; explored the cost implications of including chemotherapy as a benefit in the National Hospital Insurance Fund; researched willingness and ability to pay, formed Public Private Partnerships; and raised awareness among decision makers of the urgent need to prevent and control cancer to mobilize resources and advance philanthropic efforts of groups such as pharmaceutical companies.

Sharing Knowledge, Experiences and Collaborating to Expand Access to CCC

There are important opportunities for countries to collaborate by sharing knowledge and experiences. The CCC SSKE provided an effective platform for sharing information about the design and implementation of various programs and learning what works and what does not work. The CCC SSKE participants reported improvements in knowledge and gains from networking with one another as they continue their efforts to mobilize resources and increase access to services in their countries. Participants reported the knowledge gained would enhance policy and program design in their own countries. Beyond sharing information there are also important opportunities for countries to collaborate on joint activities. During the culminating face-to-face meeting in Lusaka, participants discussed possibilities for collaboration in addressing the shortage of qualified personnel, mobilizing resources by making a better economic case for investing in cancer care and conducting joint research to inform policy and generate knowledge of science of delivery. Several countries have developed regional training programs to build capacity for pathology, oncology, and radiation therapy. Participants plan on building on these nascent efforts to continue networking and support one another to tackle the growing cancer burden.

Introduction

Currently 80 percent of the disability adjusted years of life (DALY) lost to cancer is in low- and middle-income countries (LMICs). However, only 5 percent of global cancer resources are spent in these countries. This disparity will grow dramatically as changing lifestyles, increasing urbanization and aging populations lead to a projected doubling of the incidence of cancer in Africa by 2020. Each year, 50 percent of new cancer cases and 77 percent of cancer deaths occur in LMICs. Global health leaders are calling for greater attention to non-communicable diseases (NCDs), including cancer care and control. At the 63rd World Health Organization (WHO) Regional Committee for Africa meeting, Ministers called for action to address cancer. While some programs, including cervical cancer screening, HPV vaccination, and cancer specialty centers are getting underway, much more needs to be done in Africa. Given that African countries face common challenges and can benefit from sharing knowledge and learning from one another’s experiences developing and implementing CCC programs, a South-South Knowledge Exchange was initiated by the World Bank.

The Cancer Care and Control South-South Knowledge Exchange aimed to: (i) raise awareness of the growing importance of CCC in Africa, (ii) encourage cross-fertilization of experiences, with an emphasis on cervical and breast cancers, and (iii) facilitate access to information among participating countries. The CCC SSKE was a joint effort of the World Bank and the United States National Cancer Institute (NCI)/National Institutes of Health (NIH), designed to support knowledge sharing and networking among participants and global technical experts through a series of knowledge exchange activities.

The countries that participated in the CCC SSKE include Botswana, Kenya, Rwanda, Uganda and Zambia. They were selected because they are each at a different stage in the development and implementation of CCC programs, have different strengths, and have much to learn from one another’s experiences. They have also learned important lessons while addressing HIV/AIDS that can inform their efforts addressing cancer. During a period of 18 months, from August 2013 to February 2015, the CCC SSKE stakeholders from the five participating countries attended nine videoconferences during which they benefited from presentations on key issues, discussed common challenges and shared relevant experiences. The CCC SSKE program was developed in collaboration with participants, so that it responded to their needs and concerns and connected them with technical experts who presented current information on evidence-based interventions and recent global developments. The virtual meetings were then followed by a regional workshop in Lusaka, Zambia in February 2015 at which participants learned first hand of the achievements of Zambia’s Cancer Diseases Hospital and the African Centre for Excellence for Women’s Cancer Control at the Centre for Infectious Disease of Zambia; and identified future opportunities for collaboration. This document summarizes the highlights of the CCC SSKE presentations and
In addition to presenting a significant burden in terms of morbidity and mortality, cancer also has tremendous economic consequences. Cancer care imposes very high direct costs on health systems, communities, and households. Cancer also exacts very high indirect costs of income foregone by patients, families and caregivers; lost productivity of patients; and premature death and disability. The World Economic Forum lists the burden of chronic disease as one of three leading global economic risks based on potential impact on global productivity and economic growth. In 2010, the economic costs of productivity losses combined with treatment costs for cancer were estimated to be US$1.6 trillion, approximately two to four percent of global Gross Domestic Product. If action is not taken now, future costs will be exorbitant.

**Overview of Cancer in Africa**

**Kenya: Mortality Projections**

![Mortality Projections Graph](Image)

**Table 1: Kenya Mortality projections**

<table>
<thead>
<tr>
<th>Year</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>60,000</td>
</tr>
<tr>
<td>2020</td>
<td>80,000</td>
</tr>
<tr>
<td>2025</td>
<td>100,000</td>
</tr>
<tr>
<td>2030</td>
<td>120,000</td>
</tr>
</tbody>
</table>

LMICs in sub-Saharan Africa are shouldering a double burden of disease. While they continue to face high levels of infectious and reproductive health diseases associated with poverty and under development, they are also experiencing rapidly increasing incidence of NCDs. Worldwide, deaths from cancer exceed those caused by HIV/AIDS, tuberculosis and malaria combined, and 70 percent of cancer deaths occur in LMICs. Estimates show that by 2030, LMICs will bear the brunt of the estimated 27 million new cancer cases and 17 million cancer deaths. Much of this morbidity and mortality can be avoided if steps are taken today to strengthen CCC programs.
In 2012, approximately 715,000 new cancer cases and 542,000 cancer deaths occurred in Africa. Breast cancer contributed roughly 24 percent and cervical cancer 21 percent of all female cancers in Africa. The continent has the highest incidence and mortality from cervical cancer in the world. The most prevalent male cancers are prostrate and liver cancers.
There are proven interventions that can prevent some cancers and improve survival. An estimated fifty to sixty percent of cancer mortality in LMICs can be avoided. Most cases of cervical cancer are caused by a viral infection that is sexually transmitted and can be prevented by the HPV vaccine. Liver cancer is often caused by a virus and can be prevented by the Hepatitis B vaccine. Lung cancer is caused primarily by smoking and can be prevented by implementing policies and programs to curb smoking and promote healthy lifestyles. Early detection programs, strengthened care and treatment, and better palliative care can extend cancer survival and improve quality of life. Programs need to be developed to advance progress towards the WHO NCD Global Targets for 2025 that call for a 25 percent reduction in mortality from NCDs, including cancer, a 30 percent drop in tobacco use, and 80 percent availability of affordable drugs and technology.

Cancer Care And Control Continuum

The Zambian Model

Primary Prevention
Secondary Prevention (Screening)
Secondary Prevention (Treatment)
Cancer Treatment
Palliative Care

Awareness, Advocacy, and Mobilization
Government, Policy Environment
Infrastructure / Human Resources for Health / Training
Laboratory Systems
Equipment and Supply Chain
Medical Records (including electronic) / Cancer Registries
Data & Information Systems: Monitoring & Evaluation; Outcomes Research

Partially supported by PEPFAR (for prevention and treatment in HIV+ positive women)


Figure 4: The Zambian Model

Comprehensive CCC programs provide a range of services that meet the evolving needs of patients along the cancer continuum. Cancer prevention and control is crucial because early detection and treatment can cure 30 percent of cancers; prolong survival in another 30 percent; and improve quality of life through adequate disease management and palliative care. As illustrated by the Zambian model above, CCC initiatives can be designed to intervene at different stages of the disease as well as to strengthen specific building blocks of the health system, thereby addressing not only cancer, but also other NCDs. The WHO health system building blocks include information systems; leadership and governance; service delivery; medical products, vaccines, supplies and technology; trained medical personnel; and financing. CCC initiatives can also be integrated into programs that address other aspects of health and/or promote economic development.

Potential areas of intervention along the CCC continuum include:

- **Primary Prevention -** HPV and Hep B vaccination campaigns; behaviour change campaigns to promote healthy lifestyles; anti-tobacco initiatives and no smoking campaigns; and “sin” taxes to curb tobacco and alcohol use.
- **Secondary Prevention (screening) -** information and education campaigns to encourage breast and cervical cancer screening; cytology (Pap) screening; visual inspection with acetic acid (VIA); and HPV DNA testing.
- **Secondary Prevention (treatment) -** increased access to cryotherapy; loop electrosurgical excision procedure (LEEP); and cone biopsy.
- **Cancer Treatment -** effective linkages with specialized care providing early and late stage treatment, including standard surgical techniques, radiation, and chemotherapy.
- **Palliative Care -** linkages with palliative care programs and expanded access to opioids and radiation.

There is growing evidence demonstrating that many of these interventions are cost effective; make a significant impact on cancer prevention; prolong survival of cancer patients; and improve quality of life of both patients and their families. To be effective, these interventions require a health system in which surgery, radiotherapy, chemotherapy, pain management and outpatient and acute care services are well integrated. Immunization with the HPV vaccine and cervical cancer screening can reduce deaths from cervical cancer by 80 percent. Early stage treatment of cancer can increase long-term survival by 50 percent and palliative care can reduce suffering in 100 percent of late stage patients.

The five countries participating in the CCC SSKE are at different stages of developing and implementing CCC programs and have a range of experiences. The CCC SSKE activities addressed common challenges and innovative solutions to various aspects of designing and implementing CCC initiatives. Topics included data collection to better document the burden of disease; strategies for designing and implementing successful national CCC programs; innovative approaches for strengthening cancer prevention efforts such as HPV vaccination programs; task sharing and other strategies to build capacity and increase access to cancer screening and treatment; analytical tools for understanding the costs of CCC financing models, including public-private partnerships, to increase access to CCC treatment and care; policy reforms needed to increase access to palliative care; and opportunities for regional collaboration. Highlights of the country experiences shared, common challenges discussed and innovative solutions explored during the CCC SSKE activities are synthesized and presented in the following sections.

Cancer Registries and Information Systems

Population-based cancer registries (PBCRs) are at different stages of developing and implementing CCC programs and have a range of experiences. The CCC SSKE activities addressed common challenges and innovative solutions to various aspects of designing and implementing CCC initiatives. Topics included data collection to better document the burden of disease; strategies for designing and implementing successful national CCC programs; innovative approaches for strengthening cancer prevention efforts such as HPV vaccination programs; task sharing and other strategies to build capacity and increase access to cancer screening and treatment; analytical tools for understanding the costs of CCC financing models, including public-private partnerships, to increase access to CCC treatment and care; policy reforms needed to increase access to palliative care; and opportunities for regional collaboration. Highlights of the country experiences shared, common challenges discussed and innovative solutions explored during the CCC SSKE activities are synthesized and presented in the following sections.
Coverage of population-based cancer registries needs to be expanded, particularly in LMICs, in order to obtain more complete and reliable data and improve understanding of both current and future cancer burdens as well as site-specific patterns of incidence. There are few population-based cancer registries in Africa. One notable example is the Kampala Cancer Registry (KCR) described below.

Uganda’s Experience with the Kampala Cancer Registry

The Kampala Cancer Registry (KCR) was established in 1951 and is based at the Makerere Medical School. It has collected a unique data set that has been instrumental in improving understanding of cancer in Uganda and informing health policymaking and planning. The registry collects: (i) demographic information – name, age, gender; (ii) diagnosis information; and (iii) the source of the data. The KCR has contributed to the growing interest in cancer in Uganda and has computerized its data management using the cancer registration software, CANREG5. While other cancer registries have been established in Uganda, none has had the ongoing success of the KCR. This success results from its governance structure as part of Makerere University; its collaborative relationships with the International Agency for Research on Cancer (IARC) and African Cancer Registry Network (AFROCEN); continuous effective and committed leadership; a defined mission and clear agenda; and focused approach.

Common Challenges And Innovative Solutions In Information Systems

- Ensuring ongoing political commitment and mobilizing resources - Uganda has made cancer registration a key component of the National Cancer Control Program and charged the Uganda Cancer Institute with its implementation. Recognizing the importance of sustainable population-based data collection to inform their cancer control program, Zamba has partnered with NCI and UICC to hire and train a registry director to develop a PBCR. In Kenya, the MoH, in coordination with the United States Centre for Disease Control and Prevention (CDC), has developed a tool to determine the cost of registering one case of cancer that it will use to advocate for resources to strengthen and expand the national cancer registry.
- Ensuring reliability - The KCR data collection system has control points for review and verification by both the CANREG5 software and by manual comparison of data entries with hard copy records. KCR staff members maintain collaborative working relationships with clinicians, pathologists, as well as private sector health providers in order to obtain high quality data. They also work to standardize and improve hospital databases, and, when possible, link to electronic patient records. Other strategies to ensure data reliability include using new technologies such as smart phones.
- Increasing population coverage, particularly of rural populations - Uganda increased the personnel and infrastructure of the KCR registry and linked it with four regional cancer registries and a registry at a community cancer treatment centre to reach coverage of 30 percent of the population. This level of coverage is sufficient for estimating the national cancer burden. The community cancer registry is at a cancer treatment centre in Eastern Uganda and collects information about a rural population that is less dynamic than the urban population of Kampala. The Centre aims to collect a time series of information about individual patients so that it can improve its treatment interventions and gain insights into site-specific incidence of cancer in a rural community.

Cancer Control Planning and Programming

National health systems need to address the growing challenge of cancer by: (i) strengthening evidence-based planning to maximize program impact and efficiency; (ii) forming strategic partnerships to leverage resources and expertise; (iii) building capacity; and (iv) developing sustainable cancer control programs. Experience demonstrates that successful national plans are evidence-based and informed by research; have been developed by a diverse group of stakeholders; are comprehensive and include a range of activities that strengthen prevention, diagnosis, treatment, palliative care and survivorship; and include a strong monitoring and evaluation component.

The Kenya Cancer Control Program

Kenya has developed and implemented several landmark policies and strategies to advance its National Cancer Control Programme. These include passage and implementation of the 2012 Cancer Control Act, the 2007 Tobacco Control Act, the 2012 Alcoholic Beverages Control Act, the 2011 National Food and Nutrition Security Policy and the 2013 National Occupational Safety and Health Policy. In addition, Kenya has a number of active state and non-governmental organizations that work at the grassroots level to increase awareness about cancer and its prevention.
of official planning documents that guide their national strategy, including: 2011-2016 National Cancer Control Strategy; National Cervical Cancer Programme Strategic Plan (2012 - 2015); National Guidelines for Cancer Management (2013); Palliative Care and Training (2013); and Prevention and Management of Cervical, Breast and Prostate Cancers (2012). These milestones were achieved because the Ministries of Health (MOHs) provided strong leadership and stewardship and mobilized a diverse group of stakeholders, including representatives from academia, the private sector, hospitals, faith-based organizations, civil society organizations and patients’ groups, who developed, reviewed, disseminated and implemented comprehensive policies, plans, and roadmaps.

The National Cancer Control Strategic Plan is comprehensive and provides a sound framework for action. Significant strides have been made in each of its seven strategic areas:

- Promote cancer prevention and early detection – Interventions have focused on lowering risk factors by: (i) reducing access to tobacco through smoking bans, increased taxation and advertising limitations; (ii) promoting healthy lifestyles, including improved diet and reduced alcohol use, through behavior change programs; (iii) reducing environmental exposure to carcinogens; and (iv) preventing infectious diseases associated with cancer through HIV prevention and HPV and Hep B immunization programs.

- Improve diagnosis and treatment, including palliative care – Screening interventions have focused on cervical, breast and prostate cancers. Cervical cancer screening programs ( VIA and Flap smear) have been expanded and HPV testing, while expensive, is available through private providers. Diagnostic and treatment services are available primarily in Nairobi and large towns and capacity is being expanded to increase geographic access. Since over 80 percent of cancer cases present late, the MOH has established 11 palliative care centers in public regional referral hospitals and several faith-based and private sector organizations provide hospice.

- Promote cancer surveillance, registration and research – Two sites, the Kenya Medical Research Institute (KEMRI) and the Moi Teaching and Referral Hospital (MTRH), have cancer registries and the MOH has developed a cancer registry tool that will be disseminated to expand these efforts. Efforts to develop population-based registries are also underway in Kisumu and Nyeri Counties.

- Promote partnerships and collaboration in cancer control – To ensure that all providers are working toward common goals, they work collaboratively to develop guidelines and conduct joint training programs. Additional work will be done to develop treatment protocols and joint drug procurement systems.

- Advocate for cancer prevention and control legislation – To operationalize the National Cancer Act a National Cancer Institute is being established.

- Integrate cancer prevention and control activities with national health and socio-economic plans – Recently developed strategies and guidelines are being disseminated and implemented at the service delivery level.

- Promote community involvement and participation in cancer control and prevention – Including a diverse group of stakeholders in the development of policies and strategies has ensured buy-in and community participation.

The Uganda Comprehensive National Cancer Control Program

The Uganda Cancer Institute (UCI) and Ministry of Health are implementing the Uganda Comprehensive National Cancer Control Program. The central strategy of this program is a comprehensive cancer service network comprised of UCI, as a National Centre of Excellence, supporting highly specialized Regional Cancer Centres staffed by multidisciplinary teams. UCI mandates it to research the cause, treatment and prevention of common cancers in Uganda; provide high quality, evidence-based cancer care; provide cancer training using common cancers as models; and reduce the risk of cancer through awareness raising and information. UCI provides oncology services, including chemotherapy and radiation; gynecology and surgery services; cancer screening services; specialized oncology pharmaceutical services; hematologic clinical care; laboratory and imaging services; physiotherapy services; psychosocial support and training. Both the 2010 Uganda National Development Plan and the 2010 Uganda National Health Policy state the need for increased capacity to address cancer through a specialized unit such as the UCI. A draft cancer policy and a draft bill to establish the UCI by an Act of Parliament are in place.

UCI has collaborated effectively with Makerere University, Mulago Teaching Hospital and the Fred Hutchinson Cancer Research Centre in its efforts to research and treat childhood lymphoma and other malignancies; research pathogens and their role in causing cancers; and improve strategies for cancer prevention and treatment. UCI also provides countrywide cancer consultation services and trains oncologists. UCI is responsible for many ground breaking scientific discoveries that have enriched the understanding of cancer and led to innovative strategies for more effective prevention and treatment of the disease. It is governed by a board and is a self-accounting government entity under the Ministry of Health. UCI has recently built a six-story facility and its funding has increased from about 5.4 billion Shillings in 2009/2010 to roughly 13.5 billion Shillings in 2013/2014. It was accorded the status of a WHO Regional Centre for Cancer Research in Africa and is currently being reviewed to have that status renewed.

Two outreach regional clinics have been established in Western and North Western Uganda and land has been offered to establish two more. The Comprehensive National Cancer Control Program also includes a Comprehensive Community Cancer Program comprised of community outreach efforts to provide health education and screening for breast, cervical and prostate cancers; cancer awareness and screening at the UCI Centre; continuous medical education for lower level health care workers; television and radio talks about cancer; and development and production of information, education and communication materials. The Program also includes satellite surveillance centres that promote cancer research and registration; conduct community level surveillance; raise awareness to promote prevention and early detection; and provide simple treatment and patient follow-up.

The key elements for the success of the UCI and the Comprehensive National Cancer Control Program are effective partnerships, strong coordination, high level leadership, resources and research. UCI collaborates and partners with many international organizations and agencies, including International Atomic Energy Agency, International Agency for Research on Cancer, National Cancer Institute and Fred Hutchinson Cancer Research Centre to achieve several national cancer control goals. Working in partnership with civil society groups, such as the Uganda Cancer Society and the Uganda Non-communistic Disease Alliance, has also been critical for success.

The Rwanda National Strategic Plan for Cancer Diseases

Rwanda’s National Strategic Plan for Cancer Diseases aims to improve primary and specialized health care and treatment; increase prevention and control of risk factors; and sensitize the community to change risk behaviours and promote early detection. The Plan focuses on reinforcing primary and specialized health care and treatment by: (i) decentralizing services and training and mentoring lower level health workers to improve screening and early diagnosis; (ii) increasing access to NCD services by strengthening procurement and logistics systems for drugs,
medical supplies, and equipment, and building capacity of one regional hospital to provide radiotherapy and chemotherapy; and (ii) improving quality of NCD services by establishing cancer units inside five regional hospitals, adding radiotherapy services to one regional hospital and increasing the number of pathology units to a total of three nationwide.

Rwanda has five specialized facilities to treat cancer. In the country there is one clinical oncologist, one hemato-oncologist, 1 surgical oncologist and one gynaecological oncologist. General practitioners provide most cancer care. There are thirty dedicated oncology nurses and ten dedicated histo-technologists. Rwanda has developed national protocols for treating twelve adult cancers, including breast, colon, rectal, gastric, cervical and prostate cancers; and five paediatric cancers, including Burkitt’s lymphoma and Hodgkin’s lymphoma. There are thirty-one recommended cancer medicines on the Rwanda List of Essential Medicines and in 2014 the country spent close to US$ 630,000 for them.

Rwanda has built the capacity of its cancer program with funding, training and other types of support from many organizations including the Government of Rwanda, Partners in Health, GSK, DfID, CDC, WHO, and GAVI. Over a three-year period, the program has trained 241 doctors on topics such as baseline cancer training, LEEP and VIA/cryo, 406 nurses on baseline cancer training and in-service chemotherapy, and 49 pathology technicians on topics such as pathology outreach. Two pathologists have attended international training. The Rwanda Cancer Program runs monthly inter-facility cancer care symposia to increase cancer awareness among health care providers and enable them to share experiences and harmonize cancer management. To further promote cancer prevention and early detection the Program conducted the National Breast Cancer Symposium, the Breast Cancer Public Awareness Campaign, and the HPV/VIA screening campaign. Finally, the Program has integrated early cancer detection into annual community medical check-ups. To address current gaps the program aims to: extend the cancer registry at the five referral hospitals to also include district hospitals; ensure availability of essential medicines; conduct training in cervical and breast cancer prevention and management; procure screening and diagnostic equipment for additional district-level facilities; and complete expansion of radiotherapy infrastructure.

Cancer Management in Zambia

In 2009 the Ministry of Health developed the National Cancer Control Strategy that aims to provide a comprehensive and coordinated national response to strengthen prevention, awareness, diagnosis, treatment and care of cancer. The strategy focuses on cervical, breast, and prostate adult cancers and retinoblastoma, a childhood cancer. They are currently in the process of renewing and revitalizing this strategy. The next iteration will include policies to prevent cancer, including incorporating HPV vaccination into national policy and developing and implementing a national tobacco control program. The program also aims to strengthen prevention and early diagnosis of cancer by building capacity to conduct cervical cancer screening. Zambia has developed the Centre of Excellence for Women’s Cancers as well as the Cancer Diseases Hospital, a Regional Centre of Excellence for Cancer and Oncology Training. Currently cervical cancer screening is available at all provincial hospitals and 31 clinics. Fifteen of these sites provide LEEP and will serve as referral sites at the provincial level. The program has also built breast cancer screening capacity with ten mammography machines, one in each province in the public sector and three in the private sector. Staff members are being trained to conduct breast cancer screening and capacity is being expanded. Finally, the program is beginning to build capacity to provide PSA tests and to perform colonoscopies for early diagnosis of prostate and colon cancers.

Zambia has established the Cancer Diseases Hospital (CDH) to be a regional Centre of Excellence by 2025 and to clinically drive implementation of the national program as well as serve as a hub for workforce training. CDH’s mission is to provide equitable access to cost effective and quality cancer care services as close to the family as possible in order to save, prolong, and contribute to improvement in the quality of life. CDH aims to increase cancer care rates by 15 percent and reduce late stage presentation of cancer cases in Zambia by 2016. The state-of-the-art facility will include the latest equipment for treatment of cancer with radiotherapy and chemotherapy. To achieve program goals the hospital provides timely, quality care to reduce morbidity and mortality; develops and implements a cancer early detection and prevention program; effectively manages and develops human resources; mobilizes financial resources to deliver and expand services; provides logistical and administrative support to the program; and develops and implements a comprehensive Health Management Information System to plan, monitor and evaluate program implementation. The hospital developed its 2011-2015 Human Resources for Health Strategic Plan in which it has set the following goals: (i) increase the number employed of specialized personnel and ensure the health workforce is equitably distributed; (ii) increase training outputs and harmonize them to respond to the health sector’s needs; (iii) improve performance and productivity of health workers; and (iv) strengthen health systems and structures to support expansion and performance of personnel. Since inception the number of trained health workers has increased and currently the hospital has 35 staff specialized in oncology. The government has been supportive of the program and has funded the hospital to conduct training programs for Radiation Therapy Technology, Clinical Oncology, Radiology and Oncology Nursing.

Common Challenges And Innovative Solutions In Cancer Control Planning And Programming

• Identifying champions, allies, and influential stakeholders who need to be at the table for successful program planning and implementation - Key stakeholders include advocacy groups; cancer advisory boards; survivor and patient support groups; cancer experts; NCD experts; tobacco control experts; private sector representatives; as well as civil society. Other allies can be found in government ministries in many sectors (i.e. education and labor), not to mention, in key Ministry of Health units (i.e. NCD, oncology, family health, and, and sexual and reproductive health) at the district, regional and central levels. Finally, it is essential to involve Ministry of Finance officials. The Kenya Cancer Control Program benefited from the support of two very visible champions – Ministers of both Ministries of Health had personal experiences with cancer and were active supporters of the program.

• Creating linkages between cancer-specific programs and broad national health programs at the central, regional and district levels as well as between public and private sectors - Effective linkages need to be made with sexual and reproductive health, maternal and child health, NCD and HIV/AIDS care and treatment programs. Also, opportunities to partner with the private sector and leverage their expertise and resources are critical to increasing the impact and effectiveness of CCC interventions.

• Demonstrating economic impact can facilitate support - Ministries of Health need to make the economic case for investing in cancer in order to mobilize support and resources. The Government of Kenya supported the Tobacco Control Program because it recognized that the savings resulting from reduced future expenditures for cancer-related health services, not to mention reduced productivity resulting from disease, far exceed the tax revenues lost from fewer tobacco sales as well as the cost of the program. While there has been some interference from industry, the government has been very supportive in the implementation of the tobacco control program.

• Overcoming lack of awareness, stigma, discrimination and denial about cancer to generate broad-based support for the program - Increasingly, Kenyans have experience with cancer or know someone who has cancer and misperceptions are being dispelled. Continued research, including population-based surveys, such as a module in the Demographic and Health Survey, can help programs track changes in awareness and knowledge; contribute to better designed programs; assist in targeting resources; and help develop effective behavior change and communication programs. Highly motivated visible champions can also mobilize support for programs. While broad-based support for CCC initiatives is growing in many countries much more needs to be done to improve knowledge and awareness and early detection.
and other Epidemics, and other key development partners. The TWG formed technical subcommittees to address key issues such as moni-
toring and evaluation; cold chain requirements; strategies for reaching the target populations of girls in and out of school; capacity building for
nurses and community health workers; procurement and logistics; financing; education; and social mobilization. A key component of the
program was the comprehensive communication strategy. It included a nationwide sensitization campaign that involved all stakeholders;
was supported by political and religious leaders; used newspaper, radio and TV; and trained teachers to discuss cervical cancer and the HPV vaccine.
The program received support and technical assistance from the Rwanda MOH, the United States Centres for Disease Control and Prevention and the
International Centre for AIDS Care and Treatment Programs at Columbia University. Local leaders, community health workers and teachers
worked together to implement the program in a "public-private community partnership."
Early Detection, Cancer Diagnosis and Treatment

Zambia’s Experience Strengthening Cervical Cancer Screening – Using Nurse-Led Screening to Increase Access

In 2005, health officials determined that it would be feasible to introduce a nurse-led VIA-based, “Screen and Treat” program with a referral system of LEEP centres. To ensure quality, the program added digital cervicography. The program initially focused on HIV+ women and was supported by external resources from the United States President’s Emergency Plan for AIDS Relief (PEPFAR). To ensure sustainability the services were subsequently integrated into the Maternal Child Health program of the Ministry of Health. Currently, services are provided as part of the gynaecology exam, providing an opportunity for screen for both cervical cancer and HIV. A strong quality assurance system has been put in place, whereby digital images taken by nurses from different areas of the country are systematically reviewed in Lusaka. The MOH pays for staff and facilities and provincial-level MOH staff plan special “gyne” days. While 80 percent of women accepted being treated by nurses, follow-up has been difficult, especially in rural areas. The program added mobile patient tracking so that nurses can remind patients of appointments and follow-up with text messages. Community health workers, marriage counsellors, traditional chiefs and church leaders conduct outreach. The program received strong political support from former Zambian First Lady – Dr. Christine Kaseba-Sata. Dr. Kaseba-Sata is a gynaecologist who has been a highly visible champion for ECC activities, including hosting the 6th Stop Cervical Cancer in Africa Conference that generated a great deal of visibility and political support for the program, not only in Zambia, but throughout Africa.

“...was especially impressed by the organization of the clinic, starting with no missed opportuni-
ty for screening. The data managers plus case managers is also an excellent idea.”

Dr. Anne Nganga, Program Manager Reproductive Tract Cancers Program, MOH, Nairobi, Kenya

The comprehensive program has all of the key components and provides care nationwide through 31 centres in all provinces. In addition, the program serves as a regional training centre. To date, over 200,000 women have been screened for cervical cancer. Key challenges facing the program include the need to screen more women, faster; decreasing overtreatment rates; improving compliance of patients who have been referred to LEEP; enhancing capacity to perform radical surgery; and transitioning the program to government.

The program’s success can be attributed to: (i) piggybacking on an existing, well-funded and well-functioning infectious disease (HIV/AIDS) platform to build capacity for the treatment and prevention of an NCD (cervical cancer); (ii) adapting interventions to the local environment; (iii) assessing all phases of the program during implementation through a rigorous process of quality control and monitoring and evaluation to quickly identify and correct any weaknesses; (iv) investing heavily in surgical excision (LEEP) infrastructure and expanding histology diagnostic services to facilitate management of complex cervical lesions that exceed the therapeutic limitations of cryotherapy; and (v) strengthening the existing healthcare delivery system when weaknesses are identified during program implementation in order to innovate, enhance sustainability, and strengthen long-term success.
Both a comprehensive regulatory framework that defines tasks and competencies, as well as a coordinated and standardized training program; required revision of the regulatory framework, a strong quality assurance system, and involvement of service users. Its ongoing success depends on nursing assistants and community health workers; and from community health workers to people living with HIV/AIDS (PLHA). The Program transferred responsibilities at every level of the system: from specialized doctors to non-physician clinicians; from non-physicians to nurses; from nurses to nursing assistants and community health workers; and from community health workers to people living with HIV/AIDS (PLHA).

The Task Shifting Program was approved by the Minister and scaled up in 2009. The Program shifted tasks from specialized doctors to non-physician clinicians; from non-physicians to nurses; from nurses to nursing assistants and community health workers; and from community health workers to people living with HIV/AIDS (PLHA). The Program transferred responsibilities at every level of the system: from specialized doctors to non-physician clinicians; from non-physicians to nurses; from nurses to nursing assistants and community health workers; and from community health workers to people living with HIV/AIDS (PLHA). The Program transferred responsibilities at every level of the system: from specialized doctors to non-physician clinicians; from non-physicians to nurses; from nurses to nursing assistants and community health workers; and from community health workers to people living with HIV/AIDS (PLHA). The Program transferred responsibilities at every level of the system: from specialized doctors to non-physician clinicians; from non-physicians to nurses; from nurses to nursing assistants and community health workers; and from community health workers to people living with HIV/AIDS (PLHA). The Program transferred responsibilities at every level of the system: from specialized doctors to non-physician clinicians; from non-physicians to nurses; from nurses to nursing assistants and community health workers; and from community health workers to people living with HIV/AIDS (PLHA).

Figure 7: Task shifting at all levels of the system

Rwanda has developed and implemented a Task Shifting Program to fill the gap of trained medical personnel needed to initially address HIV/AIDS, and now being used to address cancer. From 2005-2007 the Ministry of Health and the Treatment and Research Centre (TRAC) on HIV/AIDS worked with Fameli Health International to develop and pilot test the Task Shifting Program to decentralize services and authorize nurses to prescribe antiretroviral therapy (ART). Nurses were trained to prescribe ART, provide quality HIV/AIDS prevention counselling and testing; teach patients to manage the challenges of compromised immune systems as well as the side effects of the medicines; and provide counselling to prevent maternal to child HIV transmission. The Task Shifting Program was approved by the Minister and scaled up in 2009. The Program shifted responsibilities at every level of the system: from specialized doctors to non-physician clinicians; from non-physicians to nurses; from nurses to nursing assistants and community health workers; and from community health workers to people living with HIV/AIDS (PLHA). The Program transferred responsibilities at every level of the system: from specialized doctors to non-physician clinicians; from non-physicians to nurses; from nurses to nursing assistants and community health workers; and from community health workers to people living with HIV/AIDS (PLHA).

Pathology services play a key role in several stages of cancer care and control, including accurate surveillance, reliability of cancer registries, primary prevention, cancer screening, diagnosis and staging, treatment planning, and detection of recurrence. Historically, Kenyan pathologists received their training in 5-year programs in the United Kingdom and were able to specialize in anatomic pathology, cytopathology, haematopathology, chemical pathology, immunopathology, and clinical microbiology. Pathology training capacity has been developed at the University of Nairobi (UON) that now offers a 3-year Master of General Pathology Training program, and offers regional postgraduate training at the sub-specialty level, as well as professional certificates as a Specialist Pathologist. Since 1986, the UON program has trained 70 pathologists who now work in four teaching hospitals, provincial and district level level hospitals, and private hospitals, as well as in other hospitals in the East Africa region. In 2006, the Aga Khan University Hospital developed a 4-year pathology residency program that has tracks in anatomic pathology, histaopathology, cytopathology, and forensic, as well as clinical pathology (haematology, chemical pathology, immunopathology and clinical microbiology). To date, the program has trained twelve anatomic pathologists and 11 clinical pathologists. In addition, postgraduate cytology programs have been developed and UON now offers a Master of Science in Clinical Cytology. Trainees include technologists and clinicians. This program has built regional capacity and trained pathologists from Malawi, Zimbabwe and Zambia.

UON has collaborated with regional and international professional associations such as the Kenya Association of Clinical Pathologists; the Kenya Society of Haematologists and Oncologists; the Association of Pathologists in East, Central and Southern Africa; and the International Association of Pathologists to develop post MMed Training, fellowships, continuing education seminars and workshops, and teleconferences. Currently, the College of Pathologists in East, Central and Southern Africa (COPECSA) is forming the Regional College of Pathologists and aims to establish standards of pathology training for the region and offer pathology fellowships. UON is also collaborating with the University of Stellenbosch to develop a training and research program.

Kenya’s Experience Training Pathologists

The 2013-2018 Kenya Health Sector Strategic and Investment Plan has set the following 5-year targets for indicators tracking progress towards its objective of “halting and reversing the rising burden of non-communicable conditions”: (i) 75 percent of women of reproductive age are screened for cervical cancer; and (ii) 2 percent of patients are admitted with cancer. Key strategies of the national cancer screening programme are: (i) target diseases should be a common form of cancer with high associated morbidity or mortality; (ii) effective treatment is capable of reducing morbidity and mortality should be available; (iii) test procedures should be acceptable, safe, and relatively inexpensive; and (iv) facilities that can undertake subsequent diagnosis and treatment and follow up should be available and accessible. The service package includes breast cancer screening and faecal occult blood testing for bowel cancers and breast cancer screening and annual prostate examination for all men over 50 years of age.

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Zambia’s Experience Training Radiation Therapy Technologists

Zambia has developed a cost effective regional training program in Radiation Therapy Technology. The program uses a mixed model approach that emphasizes both clinical and academic training. It is implemented by the Cancer Diseases Hospital Training College and provides hands on experience through training that is integrated into clinical operations. The program conducted a Training of Trainers in 2010 and developed its curriculum through a collaborative participatory process that involved all key stakeholders. The program has developed an evaluation and quality assurance system and has been accredited. The program graduated two cohorts of students in 2014, including 17 Zambians, 1 Malawian, 2 Eritreans, and 3 Ethiopians.

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In 1990, WHO developed guidelines for using opioids to relieve cancer pain. Despite published guidelines, a 1994 study published in the New England Journal of Medicine found that 42 percent of cancer patients received inadequate cancer pain treatment and minorities, women and older patients were more likely to receive inadequate cancer pain treatment. Barriers to accessing PC and medication to manage pain include lack of knowledge among patients and providers; myths and misperceptions; provider bias; lack of coordination of care and services; procurement policies and supply-chain issues; eligibility restrictions limiting facilities authorized to dispense the drugs and health care providers authorized to prescribe them; additional prescription requirements hindering access; such as specialized prescription pads, limits to the length of prescriptions, and referral requirements; general laws that limit access; and lack of accountability.

There are several global and regional frameworks that aim to increase access to PC including the WHO Guidelines for Cancer Pain Relief, the WHO May 2014 PC Resolution that focuses on integration, education, research and funding; and the International Narcotics Control Board efforts to strengthen control and access to narcotics. There are also several North-South Initiatives that are working to develop and advance PC integration as well as expand the evidence base.

Integrating Palliative Care into African Health Programs and Policies

African countries are gaining experience with the integration of PC into existing health services. For example, Uganda formed a Public Private Partnership to provide free access to liquid oral morphine; authorized nurses to prescribe opioids; integrated PC into the curricula for health workers, as well as for diploma, bachelors and masters level students; formed a Country PC Team comprised of both public and private sector stakeholders; and integrated PC into national HIV, Cervical Cancer and Health Sector Strategic Plans. Facilities providing PC services can now be found in 70 percent of Uganda’s districts. Swaziland has also made rapid progress in developing a national PC policy and implementation guidelines; developing and implementing a national training curricula and setting up a procurement system for oral morphine with a corresponding monitoring system.
Implementing Palliative Care – Kenya’s Experience

Increasing access to PC has been a key component of the Kenya Cancer Control Programme because over 80 percent of cancer cases present late when PC is the only treatment option. To address this growing need and make the best use of scarce resources, Kenya has strategically linked PC to cancer prevention, early detection and treatment for both adults and children. It has also mobilized both public and private sector partners and formed partnerships with key international organizations. The Kenyan Hospices and Palliative Care Association has been instrumental in initiatives to establish PC centres and train public and private sector health workers. To date Kenya has established 11 PC centres in public regional referral hospitals; 25 PC centres in county public hospitals; 9 PC centres in hospitals operated by faith-based organizations in various regions; and, established 17 free-standing hospices. PC has been integrated into training provided by most medical and nursing schools, including the Kenya Medical Training College. Five thousand health workers have participated in one-week training courses and 52 health workers have received advanced PC training. Kenya has also mobilized political leaders to support PC and has integrated PC into the 2011-2016 National Cancer Control Strategy and the 2013 National Guidelines for Cancer Management, and promulgated the 2013 National Palliative Care Guidelines. Finally, Kenya is the first African country to have the health minister, a cabinet secretary, include PC in his performance contract in order to ensure continued government action to increase access to PC.

Implementing Palliative Care – Botswana’s Experience

In 2003, Botswana participated in a WHO-supported five-country project aimed to improve PC initiatives and the quality of life of people living with HIV/AIDS and cancer. As a result, Botswana developed a comprehensive National Palliative Care Strategy. Its key components include: ensuring access to pain and PC medications at facility and community levels; building local capacity for PC provision in health care settings, hospices, day centres and homes; providing psycho-social support and wrap around care; and improving end-of-life care and bereavement support. The program was launched in 2013.

The MOH is currently implementing the PC Strategy by: (i) addressing misperceptions and improving understanding; (ii) developing guidelines and protocols for PC, as well as for pain management; (iii) implementing 5-day training programs and integrating PC into the undergraduate health curricula; (iv) increasing availability of opioids; (v) forming the Botswana Hospice and Palliative Care Association to improve coordination; (vi) improving continuity of care by strengthening linkages between acute care and PC providers; and (vii) mobilizing resources. Next steps include incorporating PC implementation plans into the National Cancer Control Plan; increasing access to opioids and training health personnel to prescribe them; and reviewing opioid regulations.

Implementing Palliative Care – Rwanda’s Experience

In 2006, Rwanda’s MOH developed a PC program and introduced PC training for hospital and non-governmental organization (NGO) staff. In 2007, PC was added to the clinical care package. In 2008, an advocacy workshop was conducted to strengthen PC delivery and morphine was added to the Essential Drug List. In 2011 a National Palliative Care Policy was approved, district level hospital workers were trained and the Palliative Care Centre at Kibagabaga was created. In 2013 the National Palliative Care Policy was integrated into the National Strategic Plan. PC is implemented at all levels of the health system and referral, provincial and district hospitals, as well as health centres and health posts provide a clinical care package while community health workers follow up with patients and support treatment compliance and home-based care. The program uses multidisciplinary teams from provincial and district hospitals and the community to coordinate care.

Priority areas for the PC program include strengthening PC at all levels of the health system; educating health care workers and conducting refresher training of district hospital staff in morphine use and pain management; raising awareness of both patients and health care personnel; improving access to services and quality of care; and conducting research to inform and improve care. Strategies used to expand the program include: (i) gaining government ownership to expand a program initially led by civil society; (ii) using the national health plan to integrate PC into services at all levels of the health system; (iii) using a core team of national trainers at the Provincial Hospital level and a cascade system of training.

The State of Oncology in Africa – 2015

Barriers to Accessing Palliative Care

Figure 9: Barriers to accessing palliative care

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Common Challenges and Innovative Solutions in Increasing Access to Palliative Care

- Mobilizing public and private sector support and resources for PC - Public and private sector policymakers need to be educated in the strategic link between PC and cancer prevention, early detection and treatment for adults and children as well as the risks of opioid addiction. In Kenya, the PC program began as a cancer-related program and then raised its visibility by demonstrating that PC services can benefit persons facing all kinds of life-threatening illnesses. It further expanded its services by working with hospice-providers, by improving linkages with cancer prevention and treatment and mobilizing MOH resources to integrate PC into hospital care, and by collaborating with donor organizations interested in improving access to PC.

- Increasing access to drugs - Rwanda and Uganda have procured morphine in an inexpensive solution form and trained compounding pharmacists to dispense it. Both countries have also used Public Private Partnerships to increase access. Finally, global efforts to negotiate with pharmaceutical companies for lower price drugs, as has been done for ART, are needed.

- Authorizing trained nurses to prescribe and better utilizing pharmacists to dispense opioids - It is essential that policy assessments and situation analyses be conducted in each country to understand the laws, policies and guidelines on the books; how they are implemented, and what their impact is on hindering access to PC. Once this information is collected, it is important to involve all stakeholders in the review and revision of regulations and policies to build consensus among doctors, nurses and pharmacists for new prescribing practices that can increase access to PC. Uganda has authorized trained nurses to prescribe morphine.

Increasing Access to an Essential Cancer Care Package

Because cancer care is costly, complex and chronic, identifying strategies for financing the continuum of CCC interventions is challenging and efforts must be made to identify cost-effective interventions. The Disease Control Priorities, Third Edition (DCP3) has for the first time a chapter on cancer that provides the state of the art evidence on cost effectiveness of various interventions. As part of DCP3 a framework has been developed to first analyze the cancer burden in a country; then determine the cost effectiveness of specified health interventions within the country context, and finally estimate the feasibility and potential impact of scaling-up the interventions. This information is then used to identify the most cost effective essential cancer care package and determine the cost of its implementation as well as its potential impact. Global financing to support cancer programs in Africa is limited and programs are typically financed through large out-of-pocket payments with some public sector support. To design a cost effective essential cancer care package the disease burden must be understood, cost effective interventions identified, and the feasibility of scaling up interventions in the specific health care setting assessed.

Cost effectiveness analyses of selected cancer control interventions conducted for the DCP3 demonstrate that HPV vaccination; comprehensive tobacco measures; and tobacco taxes are very cost effective. Similarly, high quality treatment of selected pediatric cancers for patients below age 15 can significantly reduce mortality and be cost effective. The DCP3 estimates that the marginal per capita cost of a comprehensive essential cancer package that includes these interventions ranges from about US$1.7 in low-income countries to roughly US$7.7 in upper-middle-income countries.

DCPs provides a strong economic rationale for financing selected cancer interventions and presents several potential sources of funding the addition of an essential cancer package into current health programs. If the essential cancer package were provided to approximately 5.8 billion people, approximately 3.2 million cancer deaths in people below age 70 would be averted. This would cost 3 percent of public spending for health in upper-middle-income countries; 5 percent in lower-middle-income countries; and 14 percent in low-income countries. Since the per capita income in these countries is growing, more money will become available and cancer interventions can be domestically financed. Funds can also be generated through tobacco taxes. Another important source of funds is international donor support. Currently, global priorities for reducing the costs of the essential cancer package include: (i) lowering the cost of key inputs, such as drugs and vaccines, through large scale purchasing and/or negotiated drug prices; (ii) providing technical assistance, (iii) communities of practice; and (iv) conducting research. Research priorities include: registries to better understand the disease burden, implementation science, biology, and economics, including costing.

Health system reforms being implemented in many African countries that provide opportunities for increasing access to CCC include: (i) Universal Health Coverage (UHC) to ensure financial protection through pooled, publicly financed health care; (ii) performance-based financing programs that provide financial incentives to health facilities and/or community providers based on the quantity and quality of services delivered; and (iii) Public Private Partnerships that involve contracts between public and private entities for the provision of services, facilities and/or equipment. When developing strategies for financing CCC programs within the context of these broader health system reforms, it is essential to ensure that all people can obtain health services without suffering financial hardship.

Introducing CCC into Universal Health Coverage Programs

“for cancer to be part of Universal Health Coverage, we need to start building the evidence base. There is urgent need for more information on the burden of disease, on priority interventions, and on the most cost-effective way of delivering services, bearing in mind value for money. This information will be critical in defining benefit packages, and determining what is affordable.”

Karima Salih, Senior Health Economist, World Bank

The World Bank is working with many African countries to support progress towards Universal Health Coverage, a process that depends upon a thorough understanding of the country and its capacity to collect revenues, pool funds, and purchase services. Key considerations for the design of programs to introduce cancer care into UHC programs include: clearly defining the population of beneficiaries who will receive services; determining which services to include in the benefit package; estimating the cost of services to be covered; and developing a strategy for shifting to prepayments and reducing out-of-pocket payments for care. When making these choices it is important to ensure that coverage and use are based on need, to maximize benefits and cost effectiveness by prioritizing policies that generate the greatest sum of health related well-being in a given population; ensure that contributions are fair and based on ability to pay; and ensure accountability through robust monitoring. Additional research is needed to inform these decisions and better understand the disease burden, the cost effectiveness of interventions, household out-of-pocket spending, and the incidence of catastrophic spending, especially among the poor.

Key lessons from the experiences introducing cancer care coverage into UHC programs in Thailand, Mexico, Columbia, and Peru are: (i) strategies to include cancer care coverage into national health insurance programs need to focus on improving supervision and reducing out of-pocket payments for the poor; (ii) separate catastrophic illness funds can be established and revenues can be generated from “sin taxes”; (iii) introduction of benefits needs to be slow, sequenced, and structured, focusing first on selected interventions...
for high incidence cancers and targeted populations and gradually expanding to include additional services and beneficiaries; (iv) solid data on costs and burden of disease, and efforts to ensure that entitlements translate into effective coverage are essential to success; and (v) political will is key.

Costing of Comprehensive Cervical Cancer Prevention — The Comprehensive Cervical Cancer Costing and Planning Tool

Reducing the burden of cervical cancer requires a comprehensive approach that includes vaccination, screening and treatment of precancerous lesions; detection and treatment of early to mid-stage cancers; and provision of palliative care. To plan for and provide these services it is essential to know both the financial and economic cost, including the cost of training programs; procurement and distribution of vaccines; social sensitization; delivery of services; supervision; monitoring; and program evaluation. To better understand these costs, WHO has supported development of a Comprehensive Cervical Cancer Costing and Planning (C4P) Tool. The tool can be accessed at: www.who.int/immunization/hpv/en/

The C4P Tool facilitates the process of estimating costs and designing a cervical cancer prevention program. It helps decision makers understand the components of various service delivery strategies; compare their costs; estimate their anticipated impact; discuss trade-offs, and clarify policies; it uses population data from the United Nations Development Program (UNDP), vaccine cost data from the Global Alliance for Vaccines and Immunizations (GAVI), data on the number of schools from Ministries of Education; and data on costs of other inputs such as per diem, transport, and allowances from Ministries of Finance. The C4P Tool estimates both investment and recurrent costs; predicts outputs in terms of health systems strengthening and population coverage; and allows users to compare the costs of various strategies and scenarios such as facility-based versus community-based service delivery and school-based versus community-based immunization campaigns.

The C4P Tool has been applied in 12 countries and has shown that: (i) even though financing through GAVI has reduced costs and Gardasil is now available for $4.5 per dose the cost of the vaccine remains significant; (ii) vaccine delivery costs (excluding the cost of the vaccine) are more expensive than those of routine vaccinations largely due to the challenges of reaching girls ages 9-13; (iii) costs for vaccine delivery per fully immunized girl range from $3.9 - $5.8 across countries; and (iv) factors contributing to cost differences include variations in country settings (geography, population etc.) and strategies for administering the vaccines. The C4P Tool has also demonstrated that effective and timely interventions can reduce morbidity and mortality from cervical cancer; however, successful programs require planning and a comprehensive approach.

Cost Effectiveness of Breast Cancer Prevention - Ghana’s Experience

In 2012, Ghana’s breast cancer diagnosis and treatment program covered ten percent of the population, cost $1.6 million and averted 437 DALYs (disability adjusted life years). The average cost effectiveness ratio was estimated to be $3,745. Currently, the Ghana National Health Insurance Service (GHIS) covers breast (and cervical) cancer diagnosis and treatment for its beneficiaries. However, GHIS only covers 34 percent of the Ghanaian population. Policymakers conducted a cost effectiveness analysis (CEA) to identify the most cost effective way to deliver breast cancer diagnostic services and treatment and explore strategies for increasing financing and expanding access. To conduct a CEA the DALYs resulting from a health condition in a population that can be averted by the health intervention are measured; then the cost of the health intervention is divided by the number of DALYs averted to determine the cost effectiveness of the intervention. Using this approach Ghanaian policymakers used CEA to compare three components of the breast cancer program, namely, mass media awareness, clinical breast exams, and mammography screening. The CEA indicated that in Ghana, both mass media awareness with a CEA ratio of $1364 and the clinical breast exam if provided with continuity of care with a CEA ratio of $1299 were cost effective. Mammography screening with a CEA ratio of $12,908 was not cost effective in Ghana. The CEA demonstrated that increasing the coverage of the program to 100 percent of the population would cost $16 million and would avert 12,360 DALYs annually. It also demonstrated that a package of interventions that includes mass media awareness, diagnosis, treatment and care is more cost effective than a single intervention for treatment.

Priorities for expanding the breast cancer program in Ghana include: (i) strengthening evidence of the disease burden; the costs and cost effectiveness of key interventions; and the benefits of investments in prevention and early detection; (ii) initiating a dialogue and the benefits of leveraging new partnerships to expand access to effective interventions and GHIS coverage; (iii) exploring possibilities of purchasing services from established private treatment centers; (iv) continuing to integrate breast cancer and cervical cancer screening into key programs (Maternal and Child Health, Sexual Reproductive Health, and HIV/AIDS prevention) and new initiatives (Every Woman, Every Child); and (v) continuing to build service delivery capacity.

Common Challenges and Innovative Solutions in Financing Cancer Care

• Identifying the most cost effective essential cancer care package and determining the cost of its implementation as well as its potential impact - the DCP3 research project has developed a framework for analysing the cancer burden in a country and determining the cost effectiveness of interventions within the country context. The most cost effective interventions in many country contexts are HPV vaccination programs, tobacco control measures and implementation of tobacco taxes. Kenya has successfully implemented tobacco control measures. Additional research is needed to expand the evidence base.

• Using economic analyses to make the case for investing in cancer and mobilize additional resources to support cancer interventions - Economic analyses can be effective tools for generating political support and mobilizing both global and national resources to support CCC programs. Rwanda has mobilized global resources in the form of reduced costs for HPV vaccines. Ghana has conducted a cost effectiveness analysis to determine the most cost effective way of expanding its breast cancer prevention program and is using the results to mobilize national health care resources to increase access to breast cancer screening.

• Introducing cancer care into Universal Health Coverage - strategies to include cancer care coverage into national health insurance programs need to focus on improving surwormship and reducing out of pocket payments for the poor. Coverage of cancer care benefits needs to be introduced in a slow, sequenced and structured manner that focuses first on selected interventions for high incidence cancers and targeted populations and gradually expands to include additional services and beneficiaries.

• Assessing the cost effectiveness of alternative delivery strategies - tools can be used to determine the cost effectiveness of delivering critical services using different delivery modes (for example, school-based versus community-based programs to provide the HPV vaccination to girls). This type of analysis is instrumental to making smart decisions in resource-constrained environments.
Public Private Partnerships - The Experience of AMPATH Oncology In Eldoret, Kenya

The AMPATH Oncology and Chronic Care Program is an innovative partnership between government agencies, academic institutions and private companies. Its flexible structure allows each partner to play to its strength: government agencies support research, provide an enabling environment, and ensure oversight; academic institutions contribute scientific and research expertise and negotiate agreements; and private organizations provide in-kind resources such as biosamples, targeted funding, and resource personnel.

AMPATH is based in Western Kenya and provides CCC services to a population of 18 million. It combines care and research to pursue its mission of "Care Leads the Way." To better meet the increasing needs of its patients, AMPATH expanded its original platform of HIV/AIDS services to provide a range of integrated services. As of 2013, AMPATH Oncology and Haematology Outpatient Clinic provides a variety of services for men, women and children, including for Kaposi’s sarcoma, breast cancer, lymphoma, head and neck cancers, gastrointestinal cancers, leukaeemia both acute and chronic, breast, cervical and ovarian cancer, and screening for cervical, prostate and breast cancers. AMPATH has developed collaborative relationships with nine academic institutions; multiple United States and Kenyan government agencies; several pharmaceutical companies; foundations and research organizations.

Strategies AMPATH is implementing to address CCC barriers include:

- Improving infrastructure - AMPATH is strengthening pathology infrastructure since cancer treatment can only be as good as the diagnosis. It has improved chemotherapy services by installing chemo prep hoods, improving chemo storage facilities, and installing both hardware and software programs designed to improve management and administration of chemotherapy treatment. AMPATH is also building radiology bunkers in its new cancer treatment centre. Since the majority of patients present with advanced cancers, AMPATH has established a palliative and hospice care unit. To strengthen surveillance, AMPATH has provided hardware and software support and developed a reliable cancer registry. Finally, AMPATH is collaborating with Moi Teaching and Referral Hospital to develop surgery resources dedicated to oncology cases.

- Supporting research and clinical training – AMPATH is supporting collaborative arrangements between Moi, Indiana and Toronto Universities to develop curricula, train trainers, and train medical personnel through both long- and short-term research and clinical training courses.

- Improving affordability and sustainability of services - AMPATH has worked with pharmaceutical companies to provide generic drugs for lower costs, explored the cost implications and possibility of including chemotherapy in the benefits provided by the National Hospital Insurance Fund; researched willingness and ability to pay, formed Public Private Partnerships; and raised awareness of the importance of controlling cancer to mobilize resources and advance philanthropic efforts of groups such as pharmaceutical companies.

- Increasing access to palliative care - AMPATH has improved the acceptability and use of morphine for pain management; explored the possibility of including narcotics on the essential drug list to make them more affordable; developed and conducted multiple short-term trainings on palliative care; and promoted the use of multidisciplinary teams to improve coordination and quality of care.

- Educating patients, service providers, policymakers and the community - Patient education is essential for addressing misperceptions to increase demand for services and improving understanding of side effects to enhance treatment compliance. AMPATH has developed materials on chemotherapy for patients, held multiple meetings and conferences; and disseminated research findings. Provider education through continuing education is essential for improving quality of care. AMPATH has supported chemotherapy administration courses and tumour boards – multidisciplinary meetings of medical personnel to discuss current cases, to disseminate and promote best practices. AMPATH has also supported the formation of patient support groups that have been very effective in raising awareness and generating demand for cancer screening services. Finally, AMPATH has provided technical expertise to the MOH in support of efforts to develop policies, guidelines and treatment protocols.

Additional areas of capacity building that AMPATH has supported include conducting and disseminating research and using new technologies to improve service delivery and quality of care. Ongoing challenges AMPATH faces include: generating continued political leadership and goodwill; consistent funding; collaboration at all levels in country, especially within the decentralized system; and maintaining access to cost effective drug supplies.

Common Challenges and Innovative Solutions In PPPs

- Improving coordination of public and private sector CCC providers and increasing engagement of the private sector, including through PPPs - While governments need to ensure financing of cancer programs, they do not necessarily need to deliver the services. In countries with a vibrant private sector, it may be more cost effective for governments to purchase services from private sector hospitals and clinics. In some countries, however, there are impediments to private sector provision of cancer care, such as high costs and low demand for services. Policymakers need to explore these issues and work with the private sector to identify ways to increase private sector engagement, including opportunities for Public Private Partnerships. Zambia has used a traditional PPP in which a mining company has sponsored gynaecology days for the wives of employees. Currently Zambia is hoping to form a PPP to add six satellite centres for radiology.

- Advancing research and ensuring that it is relevant and informs local programs - Strengthening the capacity of local Institutional Review Boards for both scientific and ethical reviews is essential to ensuring that research is relevant and useful. Also, including health care providers at all levels of the system, policymakers and other stakeholders in the review of research proposals helps to both ensure its relevance and build ownership of research results.

Opportunities for Regional Collaboration

There are important opportunities for countries to join together and collaborate to address the shortages of qualified personnel and limited training, serious underfunding of programs and the need to make a better economic case for investing in cancer care and control, and the limited attention to research to inform policy and generate knowledge of science of delivery. Already countries have developed regional training programs to build capacity for pathology, oncology, radiation therapy, and other needed skills. Countries are also building important regional networks of resources to support one another in addressing cancer. Zambia has developed the Centre of Excellence for Women’s Cancers and is rolling out nationwide the HPV screening program. CCC SSKE participants were inspired after seeing the Zambia program in action and commented, “I wish my Minister of Health could visit Zambia and learn from the Zambian government what it takes to allocate resources for cancer care.” Another stated, “the Cancer Control Programme for Zambia is a shining example as it has components of prevention at the African Centre of Excellence for Women’s Cancers and another Centre of Excellence in Cancer Treatment at the Cancer Diseases Hospital” Rwanda has established the Butera Centre of Excellence on Comprehensive Cancer Care, the first cancer facility in a rural area in Africa. Botsuana aims to excel in paediatric cancers. And with support of the African Development Bank, additional centres of excellence are being established. Kenya is developing a Centre of Excellence in renal medicine and Uganda in developing the East Africa Oncology Institute, an East African Centre of Excellence for South-South Knowledge Exchange.
oncology training and tertiary education in biomedical sciences. These institutions will collaborate with one another to conduct research, train staff and build CCC capacity in Africa.

CCC SSKE - Sharing Knowledge, Experiences and Collaborating to Increase Access to CCC

The CCC SSKE provided a platform for technical experts and policymakers to share experiences, discuss common challenges and explore innovative solutions to address the rapidly rising burden of cancer in Africa. The World Bank served as convener and organizer of the knowledge exchange. The Bank mobilized the United States National Cancer Institute (NCI)/National Institute of Health (NIH) to participate in the initiative, leveraging technical expertise in highly specialized areas (for example, cancer epidemiology, planning, treatment, pathology). The Knowledge Exchange is in line with the World Bank’s role as a knowledge institution, facilitating the sharing of promising approaches and providing a platform for learning. Given the modest technical capacity, limited training and meagre funding allocated to cancer care and control in Africa, the Knowledge Exchange played an important role in inspiring participants to scale up interventions in their own countries, using domestic resources or donor funding when available.

Common challenges discussed during the Knowledge Exchange include: serious shortages of trained specialists, few facilities that provide care; and underfunding of CCC services that leaves families shoultering, not only the tremendous burden of illness imposed by the disease, but also the high costs of seeking care. The CCC SSKE participating countries, Botswana, Kenya, Rwanda, Uganda and Zambia are at different stages in the development and implementation of CCC programs, are gaining experience and have many lessons to share. As one CCC SSKE participant stated: “Regional partnerships are key...countries need to put efforts into supporting each other to ease the patients’ burdens.”

Many important strides are being made. As has been seen throughout the CCC SSKE discussions, countries are designing and implementing programs and learning what works, and what does not work. CCC SSKE participants said the knowledge they gained through the exchange will enhance policy and program design. As one participant noted, “I have shared the information with my colleagues at work and also with the Ministry of Health…when engaged at the policy level, I will share the knowledge that I gained with the hope that it will help influence policy in my own country.”

CCC SSKE participants reported improvements in knowledge and gains from networking with one another as they continue their efforts to mobilize resources and increase access to CCC in their countries. As one participant noted, “I intend to advocate for increased regional capacity for laboratory diagnosis for cancer in Kenya” and another stated, “[I] plan to hold a stakeholders’ workshop to share the experience of Zambia. I will lobby for government support in setting up a cancer treatment centre in Kenya. We are hosting the First Ladies Conference in Kenya this year and we shall use the platform to lobby government for more resources for cancer care” CCC SSKE participants aim to continue sharing and exchanging knowledge and to work together to curb the cancer disease burden in their countries.

CCC SSKE – Main Results, Lessons Learned and Next Steps

In the short to medium term, the SSKE generated important results in terms of learning from promising experiences and identifying opportunities for future collaboration. Most importantly, it established a platform for clients to continue sharing tools, experiences and lessons. While not easy to measure or monitor, in the longer term, the Knowledge Exchange also will contribute to improved policies, greater collaboration, and expanded programs, funded by governments and partners. To summarize, the main results to date are as follows:

- Shared knowledge and experiences on the main building blocks of cancer care and control programs with a full range of topics covered, including:
  - Innovative approaches for strengthening cancer prevention efforts.
  - Strategies for implementing successful national CCC programs.
  - Task shifting and task sharing to increase access to care.
  - Tools for analysing CCC costs.
  - Financing models, including public private partnerships, to increase access to CCC treatment and care.
  - Data collection to better document the burden of disease.
  - Policy reforms needed to increase access to palliative care.

- Established a platform for cross country collaboration. The organizers facilitated communications across countries, to enable continual sharing of tools, experiences and latest research findings.

- Identified opportunities for collaboration (for example, join training, technical support, research) with one another and with institutions in the region such as the Centre of Excellence for Women’s Cancers in Zambia, the Butaro Centre of Excellence on Comprehensive Cancer Care in Rwanda and the East Africa Oncology Institute in Uganda. International activity in South-South collaboration was also spurred with coordinating partners like Pink Ribbon Red Ribbon, The National Cancer Institute, and United States academic institutions.

Lessons Learned

- Peer-to-peer learning through a client-oriented, participatory process offers a collegial and collaborative environment for sharing insights, experiences, and lessons. The type of learning is highly valuable, relevant, and timely as reflected in feedback from participants.

- Face-to-face interactions between practitioners and policymakers from the participating countries strengthened understanding of how innovative programs were spearheaded, resources were mobilized, and political commitment was bolstered.

- A demand-driven approach was critical to soliciting views of participants about the most relevant topics to be covered and ensuring the knowledge exchange responded to client needs.

- Strong collaboration with other technical partners was requested by participants and proved highly effective. Technical partners brought a global perspective and offered complementary information which was appreciated by all stakeholders.

- Regional partnerships are key to maximizing learning, tapping comparative advantages of different players, and promoting specialization in delivery of training programs, cancer services and research.

- Strong preparation is essential to success. The knowledge exchange activities need to be well organized, materials need to be concise, and communication channels need to run smoothly, to maximize learning for busy practitioners and policymakers. Soliciting regular feedback from participants is critical to ascertaining views and ensuring that the knowledge exchange is tailored to country demands.
Next Steps

The knowledge exchange established a platform for collaboration and information sharing which continues beyond the formal closing date. Participants are in the process of incorporating lessons learned into their national programs, continuing to exchange information and materials with peers in other countries, and deepening their collaboration with technical partners on several aspects covered during the period (cancer planning, cancer registries). Examples worth noting include: the Bank-funded East Africa Public Health Laboratory Networking Project, which will be used as a vehicle for strengthening the availability of pathology services at project-supported laboratories in Kenya and Uganda; progress in Zambia, Kenya, and Uganda on national cancer control planning, facilitated in part by the regional lessons learned and collaborations highlighted in this paper; progress on cancer registration in Kenya and Zambia, drawing from expertise from Ugandan colleagues and from bi-lateral exchange between the two countries, supported by international organizations like the NCI, CDC and PRRR, and the formation of research networks on niche cancers like Burkitt Lymphoma or oesophageal cancer across countries more heavily affected in this region.
Why this Report?

The State of Oncology in Africa, 2015’ is a unique report about cancer in Africa: it is written by health professionals working in Africa or international colleagues working closely with Africa. Overall, despite painting a depressing and deplorable picture of the current situation regarding cancer, it reflects the reality in Africa. It demonstrates how too many patients do not seek, or cannot access, professional medical services. Those who do, do so when the cancer is at an advanced stage when cure is no longer possible. Africa suffers from a lack of oncologists from all disciplines, oncology nurses and the other necessary health professionals and technicians to support their work. There is a lack of treatment centres. There is a lack of treatments. Most countries do not have any radiotherapy equipment at all. Most countries do not have access to opioid drugs for palliative care and pain control. Most countries do not have many of the cancer drugs on WHO Essential Medicines List. The situation is bound to get worse as the population grows and ages and cancer risk factors imported from high-resource countries begin to have their effect adding to the local risk factors with infections still top of the list.

It is estimated that the annual number of new cases of cancer in Africa will grow to more than one million in the next five years. Together with the immense loss in human life, there is a considerable economic setback attached to this number. However, most African nations are far from adequately scaling up their capacity to control cancer. Stefan (2015) reviewed the published data on the existing cancer control resources in Africa: the first combined effort looking at all resources available on the continent regarding cancer care. The total number of 102 cancer treatment centers, including general oncology centers, gynaecologic oncology or other single-organ malignancy units, and pediatric oncology and palliative care establishments, is not sufficient to cover the increasing needs of the African population affected by cancer (Stefan, 2015).

The evidence is clear. Over the next decades, cancer will cause Africans to suffer and die in greater numbers; much greater numbers than today.
Those professionals who do care for Africa’s cancer patients are doing a magnificent job, frequently in desperate circumstances, without adequate resources or infrastructure: they deserve our full respect, admiration and assistance. There is hope from the success of high-quality, sustainable projects such as in Eldoret (AMPATH Oncology) the work of Hospice Africa Uganda, the collaborations between Crumlin Children’s Hospital (Dublin, Ireland) and Tanzania, the development by UNC-Zambian colleagues of scalable surgical services for women with cancer and the Breast Health Global Initiative (BHGI). Unfortunately, it is not enough. Significantly, these extraordinary examples rely on international charitable donations rather than governmental funding or structural funds from official development assistance (ODA).

Cancer treatments have improved substantially. Surgery is less mutilating, Radiotherapy is less morbid and more effective, Chemotherapy is also more effective; Nutrition of patients is improving. However, many patients in Africa do not have access to these modern therapy regimes for a variety of reasons which encourage the growth of this disparity. The big question is how to get these advances to African patients?

The fact that in Africa access to health care is a major problem, cancer awareness is limited, cultural barriers are plenty, patients present with advanced disease and there is lack of the fundamental infrastructure that is required to be able to copy what is being done in developed countries compels African countries to develop alternative strategies in the treatment of cancer.

Since the development and implementation of these strategies extends beyond the current capacity of African countries, sustainable external assistance is required. An opportunity has been created by The Breast Health Global Initiative (BHGI). Among other breast cancer developments (Boyle et al., 2013), the Breast Health Global Initiative (BHGI), co-sponsored by Fred Hutchinson Cancer Research Centre and Susan G. Komen for the Cure has developed evidence-based, economically feasible, and culturally appropriate Guidelines for breast cancer for low- and middle-income countries (LMICs) to improve breast health outcomes and access to breast cancer screening, detection and treatment. These guidelines which were making development that they are not defining a “lower” standard of care for that country are readily available and user friendly (Anderson et al., 2006; Anderson, 2009). African countries should therefore put in place proper strategies to implement the guidelines to the greatest extent possible.

External assistance also comes in the form of sustainable, external collaborations. There are many other commendable academic, Governmental and charitable collaborations with African Institutions. Yet, improvements in the situation would come faster if there was some form of external assistance was required. An opportunity has been created by The Breast Health Global Initiative (BHGI). Unfortunately, it is not enough. Significantly, these extraordinary examples rely on international charitable donations rather than governmental funding or structural funds from official development assistance (ODA).

Health Global Initiative (BHGI). Unfortunately, it is not enough. Significantly, these extraordinary examples rely on international charitable donations rather than governmental funding or structural funds from official development assistance (ODA).

A second major contribution of Burkitt was in regard to the potential effect of diets high in fibre reducing the risk of cancer of the large bowel. Burkitt (1971) noted the close relationship between bowel cancer and other non-infective diseases of the bowel, such as benign tumours, diverticular disease, and appendicitis, indicating to him that these conditions may have a common or related aetiology. Their close association with the refined diet characteristic of economic development suggested to him that the reduction of dietary fibre may be a causative factor. This hypothesis was popular for some period of time but subsequent research has demonstrated that this association does not hold. However, the role of fibre in the causation of diabetes and cardiovascular disease is still a promising subject of research.

John Higginson, an Irish Pathologist, led some important work in geographic pathology in South Africa. He published extensively on Liver Cancer (Higginson et al., 1956, 1957a), Desophageal cancer (Higginson et al., 1951), gastrointestinal cancer (Higginson et al., 1961), bladder cancer (Higginson et al., 1962), as well as examining the general pattern of cancer among the Bantu (Higginson et al., 1957b) and the Bantu and Cape Coloureds (Higginson et al., 1960).

There are several more examples. Dodge et al. (1963) noted an association between circumcision and cancer of the penis in a study of men in Kenya and Uganda. Guy de Thé studied the association between Epstein-Barr Virus and Nasopharyngeal cancer in North Africa. Outstanding contributions to cancer epidemiology and pathology come from the work of few researchers such as Denis Burkitt, Albert Cook, Anton Geiser, John Higginson, Alan Linsell, Greg O’Connor and Guy de Thé among others.

Current Situation

The current situation of cancer in Africa is described in this volume in the words of African cancer specialists: the overall situation is shocking and deplorable. There is hope, however, that a better future will come from some high-quality, sustainable projects such as in Eldoret (AMPATH Oncology) (Strotzer et al., 2013), the work of Hospice Africa Uganda, the collaborations between Crumlin Children’s Hospital (Dublin, Ireland) and Tanzania, the development by UNC-Zambian colleagues of scalable surgical services for women with cancer (Patham et al., 2015) and the Breast Health Global Initiative (BHGI).

These projects, and others, contribute positively to the control of cancer on the Continent. Another major source of hope is the remarkable dedication of the doctors, nurses and ancillary staff who work in Africa in conditions that would not be tolerated in high-income countries. Progress against cancer needs to be made through strengthening general health systems, the attainment of Universal Healthcare Coverage and delivery of the sustainable development goals. These are huge challenges against a backdrop of significant social, economic and political fragility. Indeed, other serious health problems are competing. The battle against the ravages of infectious diseases continues.
The Globalisation of Cancer

The continued growth and ageing of the world’s population will greatly affect the future cancer burden and it is widely expected that the global cancer burden will double by 2030. (Boyle et al, 2008) The greatest impact will be on the rapid increase in prevalent cases of cancer and the greatest effect of the increase will fall on low-resource and medium-resource countries where, already in 2001, almost half of the disease burden was from non-communicable disease. (Boyle, 2006)

Africa and other lower-resource regions are, arguably, harder hit by cancer than the high-resource countries. Such countries often have a limited health budget and a high background level of communicable disease. Cancer treatment facilities are not universally available and life-extending therapies are often unavailable for economic reasons. Cancer and other chronic diseases, which are becoming more common, can cause devastating damage to entire families in several circumstances—including when the head of household and the only source of income for a frequently extended family succumbs to cancer or when death of the mother results in girls stopping their education to look after the household. (Boyle, 2006)

A major challenge for African countries is how to find sufficient funds to treat the large numbers of cancers which will be diagnosed in the coming years. Effective prevention will reduce the risk of cancer and effective screening will allow many others to be successfully treated for their disease. Preventive action can be implemented today to reduce the burden of major cancer killers: tobacco control against lung cancer and other forms of cancer and vaccination against cancers of the cervix and liver.

Although many African countries assign high priority in their national health strategies to chronic diseases, including cancer, the donor community and most bilateral development agencies do not as yet consider cancer control a high priority. If cancer is not given higher priority through focused global efforts, health-care systems in low-income and middle-income countries will encounter further problems as the number of cancer cases increase. More and more people will die prematurely and needlessly from cancer, with devastating social and economic consequences for households, communities, and countries. Cancer will become a major impediment to socioeconomic development in low income and economically emerging nations.

The Challenge: What Could be Done?

Despite the absence of accurate, population-based data from the majority of countries, all estimates indicate that the global cancer burden has doubled over the last 25 years and is set to double again before 2030 (Boyle et al, 2008). Not only have the incidence and the mortality increased, but the prevalence of cancer survivors has been growing at an even faster rate. This is of substantial economic importance, as a significant proportion of cancer survivors are receiving active treatment and intense follow-up.

There are paramount preventable causes for cancer in both high-resource and low-resource countries. Many are theoretically avoidable through prevention of infection and by the development and delivery of effective vaccines. Key actions whose implementation would lead to a reduction in cancer incidence have been listed in Table 2.

Simultaneously, there has been remarkable improvement in many aspects of Oncology. Over the past several decades we have better understanding of the causes of cancer, both the changeable lifestyle and environmental factors and the immutable biological. There has also been enormous progress in developing more effective treatments for many forms of cancer. Progress has been made in each of the four Pillars of Oncology (table 1) although, tragically, disparities exist at many levels of society and not every cancer patient has access to these modern advances. Even less of these advances have been implemented for the benefit of patients across the African continent.

The Four Pillars of Oncology

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.</td>
<td>Prevent all cancers that can be prevented</td>
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<tr>
<td>2.</td>
<td>Treat all cancers that can be treated</td>
</tr>
<tr>
<td>3.</td>
<td>Cure all cancers that can be cured</td>
</tr>
<tr>
<td>4.</td>
<td>Provide Palliation whenever palliation is required</td>
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The above four points represents a global Charter for populations, cancer-patients, governments, industry and society in every part of the world.

The Charter outlines in a simple manner the Rights of every patient with cancer today and for the future. Compliance with this Charter in the case of individual patients, industry and individual countries should be used as a measure of the success of Oncology.

What is needed in Africa bears striking similarities to that needed elsewhere but it must to be modified to cope with the challenges presented by the unique situation in every country across Africa. This is a continent of extraordinary diversity and richness, culturally, linguistically (there are around 2510 languages spoken across the continent) and from socio-economic perspectives.

Prevent all Cancers That can be Prevented

Avoidable causes are known for about one half of cancers in high-resource countries (such as France (Boffetta et al, 2007)) although this preventable fraction is declining, as the rates of cancers caused by tobacco use, especially cigarette smoking, continue to fall. In high-resource countries, important in cancer prevention is avoiding tobacco use, reducing alcohol consumption, avoiding excessive exposure to natural or artificial sunlight, taking all precautions to reduce exposure to carcinogenic chemicals and adopting a healthier lifestyle, including increasing physical activity and maintaining a healthy body weight, all contribute to cancer prevention. (Boyle et al, 2003)

This preventable fraction is probably higher in Africa as a large number of cancers (especially lymphoma, cancers of liver and cervix and Kaposi’s Sarcoma) are caused by infections. Many are theoretically avoidable through prevention of infection and by the development and delivery of effective vaccines. Key actions whose implementation would lead to a reduction in cases of cancer in Africa are listed in Table 2.
Do not use any tobacco product, particularly when smoked, and do not stay in the presence of others who smoke. Tobacco use is the major cause of cancer in high-resource countries (Boyle et al, 2010) and the increasing uptake of the habit in Africa is certain to contribute to the evolving epidemic of cancer in Africa. It is essential to avoid the use of any tobacco product, particularly when smoked, and individuals should not remain in the presence of others who smoke as environmental exposure does cause cancer.

Drink alcohol only in moderation. Drinking of alcohol, even in small amounts, increases the risk of several types of cancer (Boyle et al, 2013). Alcohol should be avoided or at the least consumed in moderation. Moderation in western society is usually defined as a maximum of two units of alcohol per day for men and one for women. Recommendations are lower for women in view of the increased risk of breast cancer associated with even low levels of regular alcohol consumption. A unit of alcohol is generally considered as a glass of beer, a glass of wine or a glass of spirits, each corresponding to approximately 10 gm of alcohol. However, in Africa, there is a lack of a generally accepted unit of alcohol consumption. One bottle of beer in Africa generally contains at least 2 units of alcohol, as defined by western standards.

Avoid eating mouldy and poorly stored foods. The main causes of liver cancer in Africa are chronic infection with hepatitis B virus (HBV) and, to a lesser extent, hepatitis C virus (HCV), compounded by exposure to aflatoxins, a class of carcinogenic mycotoxins that contaminate food commodities in western and Central African countries (Hainaut, 2016). Aflatoxins grow on poorly stored foodstuffs. It is imperative to avoid eating mouldy or poorly stored foods.

Walk, jog, run or take part in sports for at least 30 minutes every day. Regular physical activity is associated with a reduction in the risk of a number of cancers, especially colon cancer, cancer of the breast (pre-menopausal ages) (Pizot et al, 2016), and cancer of the endometrium. The protective effect of physical activity on cancer risk increases with increasing levels of activity though such a recommendation should be moderated in individuals with cardiovascular disease in the absence of medical advice. Everyone should walk, jog, run or take part in sports for at least 10 minutes every day.

Do not put on weight as an adult. It is important to avoid weight gain and to maintain a normal body weight. Obesity is an established and major cause of morbidity and mortality and most countries have seen the prevalence of obesity increasing rapidly over the years. Overweight and obesity have been recognized as cancer risk factors, mainly for the colorectal, postmenopausal breast, endometrial, and renal cancer, and for adenocarcinoma of the oesophagus.

Breast feed your children for 2 years. The longer women breast feed, the more they are protected against breast cancer. Therefore, mothers should breast feed for the longest duration feasible. Indeed, the cumulative incidence of breast cancer in high-income countries would be reduced by more than half if women had the average number of births and lifetime duration of breastfeeding that has been prevalent in low-income countries. Breastfeeding could account for almost two-thirds of the estimated reduction in breast cancer incidence. Ironically, promotion of infant formula in low resource countries is now impeding breast cancer prevention.

Avoid handling chemicals without adequate protective equipment. The prevention of exposure to occupational and environmental carcinogens is best brought about if:

1. Legislators and regulators adapt scientific consensus evaluations into law, and control compliance with these regulations;
2. Managers, hygienists and doctors in industry comply with these laws and regulations and encourage others to do so; and
3. Every citizen protects their own health and the health of others, by paying heed to the presence of carcinogenic pollutants and follow instructions and regulations aimed at mitigating or preventing exposure to carcinogens.

Practice safe sex – limit number of sexual partners and men should wear a condom during intercourse. Risk of cervix cancer and HIV infection increases with the number of sexual partners and the practice of unprotected sexual intercourse. Individuals with HIV/AIDS are at increased risk of several forms of cancer including Kaposi’s Sarcoma, Lymphoma and Cervix cancer.

Make sure your baby is vaccinated against Hepatitis B. Hepatitis B virus (HBV) infection is a major public health problem. Approximately two billion people are infected worldwide, and more than 400 million are chronic (lifelong) carriers. The fraction of hepatocellular cancer attributable to HBV has been estimated as 23% in developed countries and 59% in developing countries. The virus also causes a large number of deaths from non-cancerous liver diseases. Hepatitis B is clearly a public health problem in Africa (Hainaut, 2016). Widespread hepatitis B vaccination of babies in Taiwan has been shown highly effective in reducing the prevalence of hepatitis.

Make sure that young girls are vaccinated against Human Papilloma Virus (HPV). The prevention of exposure to occupational and environmental carcinogens is best brought about if:

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Randomized trials have evaluated the influence of visual inspection with acetic acid, cytology screening and HPV testing on the risk of cervical cancer death. (Sankaranarayanan et al, 2007; Sankaranarayanan et al, 2009) In addition, novel strategies such as a single visit ‘see and treat’ involving treatment of identified lesions with cryotherapy or cold coagulation in screen-positive women without evidence of cervix cancer have proven effective.

There is now strong evidence that implementation of Visual Inspection Screening (VIS) is effective and can be widely implemented in lower resource settings such as Africa. When rapid HPV testing becomes available at an affordable price it will be adopted widely. The combination of HPV vaccination and screening for chronic HPV infection has the potential to prevent the majority of cases of cervix cancer.

Implementing screening for other cancers in Africa is not straightforward. One of the criteria for screening as laid down by Wilson and Jungner (1968) is that facilities for further diagnosis and treatment should be available. Sadly, this is not the case throughout Africa at the moment. Breast cancer screening with mammography, currently the subject of some debate in high-resource countries, is expensive and resource intense. The introduction of clinical breast examination screening should wait for evidence from ongoing trials. Improving breast awareness and access to early diagnosis and treatment in health services is a valuable breast cancer control option.

Kaposi's Sarcoma is endemic and its incidence has increased substantially with the advent of the AIDS epidemic in sub-Saharan Africa. For decades, the aetiology and pathogenesis of Kaposi's Sarcoma was unknown until Chang et al. (1994) reported the discovery of the Kaposi's sarcoma-associated herpes virus (KSHV), also known as human herpes virus-8 (HHV-8), and demonstrated an aetiological link between the virus and Kaposi's sarcoma. Today, it is appreciated that there are four clinical variants of Kaposi's Sarcoma (Orem, 2016). Endemic Kaposi's Sarcoma is a variant of the disease effecting primarily older men who are not infected with the human immunodeficiency virus (HIV).

**Treat all Cancers that can be Treated**

Scientific knowledge and understanding regarding cancer treatment has grown significantly. With each new therapy demonstrated to have efficacy in treating malignant disease, the overall survival time of the group of patients with the disease in question improves. One of the great challenges is still the treatment of advanced or metastatic disease. Despite great progress in developing cancer treatments in the past decades, many cancers remain difficult to manage and frequently still carry a poor prognosis. The development of resistance to chemotherapy constitutes one of the major challenges of treatment and results in the incurability of many advanced disease.

Alas, such scenarios apply to countries at the highest resource level since each new treatment is expensive and frequently requires specialist facilities to identify suitable patients for the treatments and to deliver and monitor the treatment. In high-resource countries, two out of three people live at least five years after a cancer diagnosis. In lower-resource settings, cancer survival rates are much poorer although demonstrating wide variations. (Sankaranarayanan et al, 2011)

Effective therapy requires quality surgery, radiotherapy and the medical oncology and palliative care skills. The manpower to support the entire system needs to be trained in place and adequately funded. The residents of many African countries have yet to see and/or benefit from the recent, significant advances in surgery, radiotherapy and chemotherapy. (Ngesa, 2013)
The State of Oncology in Africa – 2015

Abdel Wahab et al (2013) made a longitudinal assessment of the status of radiation oncology resources in Africa to measure the extent of the problem and the effects of programmes designed to enhance radiation services in the continent. Radiation Oncology departments in Africa were surveyed through the Directory of Radiotherapy Centres, and this information was supplemented by that available from International Atomic Energy Agency Regional African and Interregional project reports for 2010. Of 52 African countries included, only 23 are known to have external beam radiation therapy. These facilities are concentrated in the southern and northern states of the continent. Brachytherapy resources (high-dose rate or low-dose rate) were only available in 20 of the 52 African countries. Although progress has been made in the establishment of radiation oncology services in some countries, a large need still exists for basic radiation services, and much resource mobilisation is needed for services to keep pace with the burgeoning populations of many countries.

Furthermore even the radiotherapy treatment machines in low-income countries are usually the older cobalt 60 machines that are frequently out of order. Most of these countries have no linear accelerators capable of generating electron beam therapy or Multi Leaf Collimators. (Johnstone et al, 2016) With only Cobalt 60 habitats available, it makes it impossible to implement radiotherapy protocols to the standards available in high-income countries. Lack of radiotherapy facilities in low-income countries is a challenge which needs to be solved in order to improve the care of cancer patients (Njoga et al, 2016).

The important role of chemotherapy in the treatment of many forms of cancer is undisputed. However, the cancer chemotherapy drugs widely available in high-income countries are often not available in Africa. Most countries do not have many of the oncology drugs listed on the WHO Essential Medicines List. When available, these drugs are usually unaffordable to most patients and difficult to administer. Prescribing and delivering chemotherapy is frequently complex and is not as simple as writing a prescription for anti retrovirals, anti-hypertensives or statins. Cancer chemotherapy rarely comprises pills that can be administered by the patient in their home. In addition, there needs to be continual monitoring and assessment of patients receiving chemotherapy.

The delivery of cancer chemotherapy in Africa is hindered by widespread lack of healthcare professionals skilled in administering chemotherapeutic agents, access to laboratories for blood count analyses and effective antiemetic and supportive treatments. It is also important to note that most chemotherapeutic regimens have been field tested in clinical trials in high-income countries and that there is a possibility that treatment results from high-income countries are not generalizable to Africa, where the infrastructure, supportive care, patient and tumour characteristics differ markedly. (Magath, 2003) In a situation like this, local clinical trials to establish what works best in low-income countries are highly recommended rather than embracing the one size fits all notion and the dangerous assumption that more expensive and newer drugs are better.

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The net result is that cancer patients in Africa who could benefit from new therapies are missing out.

**Provide Palliation Whenever Palliation is Needed**

There have been major improvements in all aspects of Palliative, Supportive and Terminal Care in the past decades although these improvements have been slowly introduced in many high-resource countries. It is also disquieting that the little that is known about the quality-of-life of cancer patients comes from a remarkably small number of well-designed trials. Palliation is needed not only for pain control but the end of life, but should be available at every part of the cancer pathway: at the time of surgery, radiotherapy and during chemotherapy. In Africa the situation is frankly appalling. There are very few trained in palliative care. Radiation therapy is very useful for pain control but approximately 30 African countries do not have a single radiotherapy machine. More than two dozen African countries have outlawed the importation of opioid medications. Where opioids are available, the average defined daily dose varied several hundred-fold. Paracetamol is not an effective medication for the control of severe cancer pain, but that is all that is available in too many countries.

There are nearly 30 countries without both opioid medications and radiotherapy. In these countries, hopes of a pain-free, dignified death from cancer is a priority that needs to be urgently addressed.

Patients living with and dying from cancer have the fundamental right to do so with dignity and comfort irrespective of their disease or where they live. The contrast between high-income and low-income countries in terms of supportive, palliative care and terminal care is even greater than for cancer treatment services. This year, more than 8,000,000 people internationally will die as a direct result of cancer, many of whom will have had their lives substantially shortened. This will rise to 17 million people by 2030. (Boyle et al, 2009) The predictable effects of advancing cancer challenge health systems to plan for and resource the relief of the suffering experienced by people and their caregivers as the disease progresses within a public health framework.
The continuing improvements in cancer prevention, early detection and treatment are overshadowed by premature mortality as a result of cancer. In resource-rich countries, two out of every five people diagnosed with cancer will die prematurely. This can rise to nine out of ten people in resource-poor countries where late presentations and limited resources deliver poor survival rates and, frequently, deaths in atrocious circumstances.

The control of pain and suffering is central to health, and the right to health is stipulated in several international declarations. The Korean Declaration (2001) states that ‘Every individual has the right to pain relief’. The Cape Town Declaration (Mpianga Sebuyira et al, 2003) states that the control of pain and symptoms is a human right. Appropriate drugs for pain control should be available in every country in sub-Saharan Africa as part of the essential drug list. This includes opioids such as morphine. Sadly, this is not the case in Africa.

Palliative care is an important aspect of treatment that is needed but poorly provided in Africa, and in many other low-income countries around the world. There is a lack of health care professionals skilled in palliative care. The few skilled palliative care workers are often restricted in their ability to provide comfort care and pain relief for cancer patients, especially as part of end-of-life care because many common and effective pain medications, such as morphine, are not readily available (World Health Organization, 1996).

The Practical: What Must be Done

There is a wide variety of statistics available regarding cancer in Africa although most, if at best, provide estimates of the situation. However, statistics are patients with the tears wiped away. It is bad to have cancer and worse to have cancer if you are poor and disconnected from the public health system.Alarmingly, the gap between rich and poor, highly educated and less educated and the North-South divide is substantial and continuing to grow. Radical solutions to improve the situation in the poor countries are urgently needed: the status quo is not an appropriate response to the current situation. Recognising that no single government or source of philanthropy has the means to solve this problem, new models are needed to cope with and improve this situation.

It is bad to have cancer and worse to have cancer if you are poor. The gap between rich and poor, highly educated and less educated and the North-South divide is substantial and continuing to grow. Radical solutions to improve the situation in the poor countries are urgently needed: the status quo is not an appropriate response to the current situation. Recognising that no single government or source of philanthropy has the means to solve this problem, new models are needed to cope with and improve this situation. It is impossible to avoid the conclusion that there is a need for major increases in expenditure to the current situation. Recognising that no single government or source of philanthropy has the means to solve this problem, new models are needed to cope with and improve this situation.

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The current situation regarding Cancer in Africa is quite deplorable. Many patients do not seek medical advice. Those who do, do so when the cancer is at an advanced stage when cure is no longer possible. There is a lack of oncologists of all kinds, nurses and the necessary health professionals and technicians to support their work. There is a lack of treatment centres. Most countries do not have any Radiotherapy equipment. Most countries do not have access to opioid drugs for palliative care and pain control.

The situation is bound to get worse as the population grows and ages and cancer risk factors imported from high-resource countries begin to have their effect. The evidence is clear. Over the next decades, cancer will cause Africans to suffer and die in greater numbers, much greater numbers. It is essential to move from a passive position to an active voice. We can turn our heads and walk away from this situation and betray all those wonderful clinicians, nurses and other personnel grasping with the overwhelming problem of cancer on the Continent. Or, we can do something.

There is an overwhelming and urgent need for international leadership and coordination in the area of Oncology. Compared with other global health communities, the global cancer control community is diffuse and often ineffective. It needs to be re-launched and to acquire focus and
Chapter 19 – The Way Forward

Table 3: Call for Action

This is a call to African governments, foreign governments and international organizations to address the challenge posed by Cancer in Africa with specific, coordinated actions:

1. There is a need to train more oncologists and health professionals in cancer care and provide the necessary infrastructure which is urgently needed to identify and treat patients. More general and specialist surgical capacity is critical as are concomitant enhancements in imaging and pathology.

2. The drugs and equipment necessary to treat patients with cancer must be made available. As a minimum each country should ensure the supply of all cancer drugs on the WHO Essential Medicines List. We need to deliver, install and maintain adequate numbers of resource appropriate Radiotherapy machines. It should be the right of cancer patients, no matter where they are to have access to the appropriate treatment of their disease.

3. Opioids must be available for controlling the pain of patients with terminal cancers (and other diseases). International Agencies should make this a priority activity and come to agreements with Governments of countries where these are not available.

4. Since half of cancer in Africa is currently caused by chronic infection, relevant infection control and vaccination programmes must be funded and implemented continent-wide.

5. Information and education campaigns to wipe out stigma and misinformation must be conceived and disseminated.

6. Making Universal Health Coverage globally available and strengthening health systems is critical for improving cancer care. This is also a critical area for the corporate and social responsibility agendas for the private industries including all trans-African corporations.

7. High quality cancer institutions, all over the world, should establish collaboration ventures with cancer centres and institutes in every African country, as well as with public health services.

8. International philanthropy is vital to help fund these efforts.

9. The International Covenant on Economic Social and Cultural Rights (ICESCR) should be invoked as the basis for action. This multilateral treaty provides that State Parties to the Covenant recognize the right of everyone to the enjoyment of the highest attainable standard of physical and mental health. Article 12.2 contains important determinants of the right to health such as prevention and treatment of diseases essential for the enjoyment of the right.

Priorities. Such priorities must be realistic and achievable, and include a focus on low-resource and medium-resource countries and the identification, delivery, and assessment of effective cancer control measures. These should emphasise strengthening the roles of surgery, medical oncology, radiation oncology, pathology and all related diagnosis and treatment specialties. The time has come to give more consideration to developing effective patient organisations in low-resource settings and to give conservation to care givers, whose work can be physically and emotionally draining.

As with cancers everywhere, cancer in Africans deserve to be prevented, to be treated, to be cured and to be palliated. If we don’t do it now, starting immediately, it will be too late and Africa’s cancer crisis will continue to grow out of control. The cancer situation in Africa is critical.

Call for Action

Radical solutions are necessary: the status quo is not an option. There is hope in the sense that there are outstanding examples where effective and efficient oncological services function. There are clearly identified needs. Global Society cannot, once again, react too slowly to an African health crisis.

Along with a long list of distinguished cancer specialists, we call on African governments, foreign governments and international organizations to address this challenge with specific, coordinated actions (table 3).
First of all, there is a need to train more oncologists and health professionals in cancer care and provide the necessary infrastructure which is urgently needed to identify and treat patients. More general and specialist surgical capacity is critical as are concomitant enhancements in imaging and pathology.

Two, the drugs and equipment necessary to treat patients with cancer must be made available. As a minimum each country should ensure the supply of all cancer drugs on the WHO Essential Medicines List. We need to deliver, install and maintain adequate numbers of resource appropriate Radiotherapy machines. It should be the right of cancer patients, no matter where they are to have access to the appropriate treatment of their disease.

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This is a call to African governments but also to the many foreign governments and international organizations who are distancing themselves from the enjoyment of the right.

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References


The State of Oncology in Africa 2015

‘The State of Oncology in Africa, 2015’ is a unique report about cancer in Africa, written by health professionals working in Africa or international colleagues working closely with Africa.

Overall, despite painting a depressing and deplorable picture of the current situation regarding cancer, it reflects reality. It demonstrates how too many patients do not seek, or cannot access, professional medical services. Those who do, do so when the cancer is at an advanced stage, when cure is no longer possible.

Africa suffers from a lack of oncologists from all disciplines, oncology nurses and the other necessary health professionals and technicians to support their work. There is a lack of treatment centres. There is a lack of treatments. Most countries do not have any radiotherapy equipment at all. Most countries do not have access to opioid drugs for palliative care and pain control.

The crisis is bound to get worse as the population grows and ages and cancer risk factors imported from high-resource countries begin to have their effect, adding to the local risk factors, with infections still top of the list.

Global Society cannot, once again, react too slowly to an African health crisis.