Program against Cancer in Africa Low and Middle-Income Countries

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Abstract

Worldwide, one in eight deaths is due to cancer. Projections based on the GLOBOCAN 2012 estimates predict a substantive increase new cancer cases per year by 2035 in developing countries if preventive measures are not widely applied. According to the World Health Organization (WHO), millions of lives could be saved each year if countries made use of existing knowledge and the best cost-effective methods to prevent and treat cancer. Therefore, the aim of this study is to estimate a provisional budget against cancer in low and middle incomes countries, according the GNI-PPP, the cancer incidence and the number of populations. Economically country classification is determining with the Gross national income (GNI), per capita, Purchasing power parity (PPP), according the administrations of the International Monetary Fund (IMF), the World Bank (WB) and the Central Intelligence Agency (CIA). Cancer incidence data presented are based on the most recent data available at IARC. However, population compares estimates from the US Bureau of the Census. The provisional budget is establishing among the guidelines developed by WHO for regional and national cancer control programs according to national economic development. Provisional budget against cancer is estimated to 8,774,987 (thousands of U.S $) for a population of 1,112,913,313 persons in Africa.

Keywords: Cancer Program; Cancer Control; Prevention; Early Detection; Institutional Reinforcement; Diagnosis; Treatment; Low and Middle-Income Countries; Africa.

Introduction:

Worldwide, one in eight deaths is due to cancer. Cancer causes more deaths than AIDS, tuberculosis, and malaria combined [1]. When countries are grouped according to economic development, cancer is the leading cause of death in developed countries and the second leading cause of death in developing countries [2]. Rates of cancers common in Western countries will continue to rise in developing countries if preventive measures are not widely applied [3-5]. Projections based on the GLOBOCAN 2012 estimates predict a substantive increase to 19.3 million new cancer cases per year by 2025, due to growth and ageing of the global population. Incidence has been increasing in most regions of the world, but there are huge inequalities between rich and poor countries. More than half of all cancers (56.8%) and cancer deaths (64.9%) in 2012 occurred in less developed regions of the world, and these proportions will increase further by 2025 [6]. By 2030, the global burden is expected to grow to 21.4 million new cancer cases and 13.2 million cancer deaths [7]. Rates of cancers will continue to rise by 2035 with 23,980,858 new cancer cases [3-5].

In addition to the human toll of cancer, the financial cost of cancer is substantial [8-10]. Cancer has the most devastating economic impact of any cause of death in the world [10]. Data limitations do not allow estimating the worldwide economic costs of cancer. However, portions of the total costs of cancer have been estimated to be as high as $895 billion (US) worldwide [9,10]. It is estimated that more than half of all cancer cases and deaths worldwide are potentially preventable [3-5,7].

According to the World Health Organization (WHO); Entitled: National Cancer

Programs: Policies and Managerial Guidelines, millions of lives could be saved each year if countries made use of existing knowledge and the best cost-effective methods to prevent and treat cancer [11].

In Nigeria, the number of new cancer cases is estimated to 105,482 with 71,521 deaths in 2015. By 2025, incidence is expected to grow to 141,878 with 96,275 deaths. Rates of cancers will continue to rise to 192,707 new cancer cases by 2035 with 131,211 deaths if preventive measures are not widely applied [3-5]. According to the World Health Organization (WHO) ; Entitled : National Cancer Control Programs : Policies and Managerial Guidelines, millions of lives could be saved each year if countries made use of existing knowledge and the best cost-effective methods to prevent and treat cancer [11].

"An urgent need in cancer control today is to develop effective and affordable approaches to the early detection, diagnosis, and treatment of breast cancer among women living in less developed countries," explains Dr Christopher Wild, Director of IARC. "It is critical to bring morbidity and mortality in line with progress made in recent years in more developed parts of the world." [6].

With the data highlighting a large variability of GNI/capita even within similar income levels in the various world regions, it is expected that additional investment in resources and costs may be more dependent on income level of the country than on the GNI group or the geographic region of the world [12]. Therefore, the aim of this study is to estimate a provisional budget against cancer in Low and Middle-Incomes Countries from Africa, according the GNI-PPP, the cancer incidence and the number of populations.

Methods:
Economically Country Classification:

The economics states are established among the means of GNI-PPP according the administrations of the International Monetary Fund (IMF); the World Bank (WB) and the Central Intelligence Agency (CIA) [13-15]. The difference concerning the same country can be considerable among the data origin. These variations are explaining by:
- GNI-PPP is estimated
- Anterior projection of an economic crisis changes GNI-PPP data
- The estimation of the population included in the local population
- The choice elements for GNI-PPP evaluation have some subjective part.

These data must be taken with precaution
Economically Country is divided according to the gross national income (GNI) per capita 2016, Atlas method and PPP [15].
- Estimated to be low income ($1,005 or less)
- Estimated to be lower middle income ($1,006 to $3,995)
- Estimated to be upper middle income ($3,956 to $12,235)
- Estimated to be high income ($12,236 or more).

Gross National Income (GNI), Per Capita, Purchasing Power Parity (PPP):

Gross national product is gross domestic product (GDP) plus net income (employee compensation and investment income) from abroad. GNI, per capita is GNI divided by mid-year population. PPP is purchasing power parity; an international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. PPP exchange rates are used to account for the local prices of goods and services not traded internationally. However, PPP is used to compare across national accounts, not for making international poverty comparisons [15].

Cancer Incidence:

Incidence is the number of new cases that occurs during a given period of time in a specified population. It can be expressed as an absolute number of cases per year or as a rate per 100,000 persons per year. The rate provides an approximation of the average risk of developing a cancer. Cancer incidence data presented are based on the most recent data available at IARC. GLOBOCAN 2012 provides a global profile of cancer that has been developed using a number of methods that are dependent on the availability and the accuracy of the data. National sources are used where possible, with local data and statistical modeling used in their absence [3-5]. However, there hasn't cancer incidence available in São Tomé and Principe.

Population:

Standard population (POP_{st}) is determining to Senegal population (Western Africa) with 14,668,522 persons. Low and middle-incomes countries population from Africa is estimated to 1,112,913,313 persons. Population compares estimates from the US Bureau of the Census [16] based on statistics from population censuses, vital statistics registration systems, or sample surveys pertaining to the recent past and on assumptions about future trends: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html

Provisional Budget (thousands of U.S $):

The World Health Organization (WHO) emphasizes that, when developing national strategies for controlling cancer, countries should consider the following four broad approaches based on their economic development:
- The primary prevention
- The early detection and secondary prevention
- The diagnosis and treatment
- The palliative care.

The provisional budget is establishing among the guidelines developed by WHO for regional and national cancer control programs according to national economic development [11]. However, an International Atomic Energy Agency [17] report suggested that in developing countries at least 60% of cancer patients require radiation treatment.
Radiotherapy is one of the main components of modern cancer treatment and requires substantial capital investment, trained professionals in several disciplines, high precision equipment and a particular external and internal organizational structure. In High Incomes Countries, the healthcare costs can be as much as 8.4% (UK in 2007) to 18% (USA in 2009) of a country's gross domestic product [18]. Cancer consumes about 5-10% of the global

healthcare budget, of which radiotherapy only consumes about 5% [18,19]; thus, more than 50% of cancer patients requiring radiotherapy in low and middle-income countries lack access to treatment. A benchmark of between 400 and 500 patients per treatment unit per year has been used to calculate machine throughput in several reports [17,20-21]. The benchmark of 450 patients per machine, which corresponds to about 8 operating hours per day, seems adequate for High Incomes Countries. For scenarios where radiotherapy demand is not satisfied, a treatment day of 10 h optimizes the utilization of equipment and decreases the number of machines needed. But, the range of needs currently covered varies from 0% and 3-4% in Low Incomes Countries in Latin America and Africa up to 59-79% in Up-Middle-Incomes Countries in Europe-Central and Asia [22].

However, in this study, in order to found the best cost-effective methods to prevent and treat cancer, the number of machines needs is establishing among 3 millions of peoples and not by the number of cancer cases, according to the weakness of the countries incomes from Africa.

Standard budget for 5 years (S₀):

Standard budget for 5 years (S_0) is estimated using a population of 1,000,000 persons in Senegal (POP_{st}). Senegal has 8361 new cancer cases (CI_{st}) in 2015 [3-5] with a means GNI-PPP$_{st}$ of US\$ 2,551 referred to the year 2016 (low middle income country), according the administrations of the International Monetary Fund (IMF); the World Bank (WB) and the Central Intelligence Agency (CIA)[13-15]. Estimation budget is taken into account the weakness of the country's incomes from Africa.

Standardized rapport (R₀):

Standardized rapport (R_0), among the GNI-PPP, CI and the number of the population, is calculated. Standardization simplifies comparisons of GNI-PPP and cancer incidence rates among populations.

$$R_0 = \frac{GNI\text{-}PPP \times CI/POP}{GNI\text{-}PPPst \times CIst /POPst}$$

Note:
* For Radiotherapy equipment, $R_0 =$ GNI-PPP X POP / GNI-PPPst X 3 million peoples;
Senegal has installed two new radiotherapy machines in 2017. Radiotherapy equipment is estimated to US\$ 2,500,000.
** For Prevention and screening infrastructure, $R_0 =$ GNI-PPPX POP / GNI-PPPst X 3 million peoples.

$R_0=$ Standardized rapport among the GNI-PPP, CI and the number of the population
GNI-PPP= Gross National Income Per capita Purchasing Power Parity of interest
$CI_{st}=$ Standard Cancer Incidence in Senegal
GNI-PPP$_{st}=$ Standard Gross National Income Per capita Purchasing Power Parity in Senegal
CI= Cancer Incidence of interest
POP$_{st}=$ Standard Population in Senegal
POP= Population of interest

Results:

Country	Population	GNI-PPP	Cancer Incidence	Budget US$
Angola	29,310,273	6,760	11,420	225,066,497
Benin	11,038,805	2,152	5,985	33,803,542
Burkina Faso	20,107,509	1,769	8,167	41,299,399
Burundi	11,466,756	801	7,614	15,224,554
Cameroon	24,994,885	3,332	14,870	126,968,316
Cape Verde	560,899	6,540	338	7,782,078
Central African Republic	5,625,118	686	2,876	6,500,819
Chad	12,075,985	2,315	6,265	38,522,176
Comoros	808,080	1,520	481	3,614,356
Congo, Democratic Republic	83,301,151	794	40,496	86,980,024
Congo, Republic	4,954,674	6,343	2,327	40,331,765
Côte d'Ivoire	24,184,810	3,577	11,603	112,703,613
Djibouti	865,267	3,376	609	6,988,412
Egypt, Arab Republic	97,041,072	11,904	113,996	3,050,851,480
Eritrea	5,918,919	1,357	3,727	12,782,535
Ethiopia	105,350,020	1,833	67,243	310,521,944
Gambia,	2,051,363	1,662	643	4,818,478
Ghana	27,499,924	4,317	16,175	179,449,419
Guinea-Bissau	1,792,338	1,465	6,282	5,550,610
Guinea	12,413,867	1,603	896	24,613,598
Kenya	47,615,739	3,289	46,252	352,278,784
Lesotho	1,958,042	3,342	1,471	11,898,964
Liberia	4,689,021	830	2,295	6,692,079
Madagascar	25,054,161	1,482	19,484	69,673,616
Malawi	19,196,246	1,125	16,859	44,706,189
Mali	17,885,245	2,206	9,750	56,368,457
Mauritania	3,758,571	4,195	2,205	23,786,93
Morocco	33,986,655	8,116	36,138	669,307,608
Mozambique	26,573,706	1,208	23,790	67,503,983
Namibia	2,484,780	11,201	1,338	39,406,012
Niger	19,245,344	1,060	6,905	21,824,998
Nigeria	190,632,261	5,931	105,482	1,633,149,440
Rwanda	11,901,484	1,920	9,058	42,148,788
São Tomé and Principe	201,025	3,236	-	-
Senegal	14,668,522	2,551	8,361	55,251,435
Sierra Leone	6,163,195	1,558	3,107	12,960,163
Somalie	11,031,386	400	8,359	9,169,203
South Sudan	13,026,129	3,010	9,854	71,973,042
Sudan	37,345,935	4,369	22,246	248,987,936
Swaziland	1,467,152	8,865	949	21,128,732
Tanzania	53,950,935	2,971	37,398	274,695,059
Togo	7,965,055	1,501	3,825	15,586,025
Tunisia	11,403,800	11,474	13,668	351,574,818
Uganda	39,570,125	1,986	32,989	155,939,665
Zambia	15,972,000	3,889	11,411	108,992,604
Zimbabwe	13,805,084	1,987	17,044	75,609,170
Total	1,112,913,313			8,774,987,315

Table 1: Estimated Budget (thousands of U.S $).

Conclusion:

Cancer has the most devastating economic impact of any cause of death in the world. Incidence has been increasing in most regions of the world, but there are huge inequalities between rich and poor countries. Projections based on the GLOBOCAN 2012 estimates predict a substantive increase to millions new cancer cases per year by 2030.

Rates of cancers will continue to rise by 2035, in developing countries from Africa if preventive measures are not widely applied. An urgent need in cancer control today is to develop effective and affordable approaches. It is expected that additional investment in resources and costs may be more dependent on income level of the country than on the GNI group or the geographic region of the world. However, in order to found the best cost-effective methods to prevent and treat cancer, provisional budget against cancer is estimated 8,774,987 (thousands of U.S $) for a population of 1,112,913,313 persons, in low and middle incomes countries from Africa, according the GNI-PPP, the cancer incidence and the number of population.

It is very important for all organizations to be aware of the complexity of cancer control. A flexible approach is needed. This account must be added to the actual supply efforts of cancer prevention and treatment. However, effective measures to reduce cancer morbidity and mortality require the active participation of cancer survivors and their local communities; the mobilization and appropriate allocation of resources; the formulation of evidence-based policies and proven interventions; and the commitment of organizations and institutions in the nonprofit, for-profit, and governmental sectors. Ultimately, cancer control goes hand in hand with efforts to promote human and economic development and to improve standards of health, education, and medical care throughout the world.

BCNet is being set up to support the development of Low and Middle-Income Countries (LMIC) biobanking through networking and collaboration between LMIC members and international biobanking societies and organizations. The network aims to provide access to standardized protocols, best-practice principles, and appropriate guidelines and tools for developing high-quality LMIC research infrastructure.

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