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Review

Financial costs of pediatric cancer management in Africa: systematic review and meta-analysis

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Abstract: The high costs of cancer treatment and lack of investment in health care are significant obstacles to public health on the African continent. The objective of this study was to estimate the financial cost of treating children suffering from cancer in Africa. We conducted a systematic review and meta-analysis of expert opinions between March 2000 and March 2020. The key search terms included 'cost', 'cancer' and 'child'; we selected articles that specifically addressed the financial costs of childhood cancer in African countries. Of the 103 articles found, 18 met the inclusion criteria. Cancer care was a heavy financial burden in most of the countries studied, although costs varied from country to country; the average expenditure on healthcare was US$1017.39 ± US$319.1 per year. In countries without a health insurance system, the highest proportion of cancer care costs, 46.6%, was indirect, whereas in countries with a cancer financing system, the direct cost of treatment was low, 53.4%. The cost of treating childhood cancer is high in Africa in relation to the standard of living of individuals residing in this region.

Keywords: Childhood cancer, financial costs, Africa, systematic review, meta-analysis.

1. Introduction

Long considered the prerogative of high-income countries, cancer today no longer spares Africa, where the numbers of new cases and deaths are skyrocketing (a nearly 100% increase is expected by 2030) (Ferlay et al., 2008). The high costs of cancer treatment and lack of investment in health care are significant obstacles to public health on the African continent. African countries pledged through the Abuja declaration to allocate 15% of their gross domestic product to the healthcare sector; however, that objective has not been reached (Witter et al., 2014). In most African countries, patients bear a high percentage of healthcare expenses (World Bank, 2013 ; Alam and Mahal, 2014). Public health spending on the continent has mainly targeted infectious and parasitic diseases (AIDS, malaria, tuberculosis, etc.) and not cancer, and public aid from developed countries has similarly been targeted against epidemics, such as the Ebola virus and other crises, leaving the fight against cancer relegated to the background (Chattu et al., 2021 ; Mjumbe et al., 2020). According to the Global Task Force on Expanded Access to Cancer Care and Control, only 5% of the world's cancer resources are spent in developing countries, and individual countries must draw up their own multi-year cancer plans adapted to their own socio-economic situations (Knaul et al., 2011). To our knowledge, no researcher has specifically estimated the costs of treating paediatric cancers in Africa. Thus, our objective with this work was to help with estimating the financial costs of paediatric cancers in Africa.

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2. Materials and Methods

The continent of Africa covers 20.3% of the land area on Earth and 6% of the total surface. The continent has an area of 30,415,873 km² (Khiri and Ibhi, 2015), and Africans represent 16% of the world' population. For this study, we conducted systematic and advanced searches without language restriction using keywords on cancer costs in children in Africa in the following databases: Index Medicus African Health of the World Health Organization (AFROLYB, AIM, Global Health Library), PubMed, Cochrane Library, CISMeF, and Google Scholar. Additionally, we performed a standard search using search bots. We searched for article titles, summaries, reports, briefs, and any other electronic presentation for data on Africa without restriction on format type or year. The searched keywords were as follows: 'cost of cancer', 'childhood cancer - socioeconomic factors', 'cancer financing in Africa', 'prospective study' and 'African continent' using the logical separators AND (AND) and OR (OR).

The research items used were the following: ('childhood cancers' [MeSH Terms] OR ('cost' [All Fields] AND 'cancer' [All Fields]) OR 'childhood cancer Africa' [All Fields] OR ('cost' [All Fields] AND 'cancer' [All Fields]) AND ('diagnosis' [Subheading] OR 'diagnosis' [All Fields] OR 'cancer' [All Fields] OR 'cost in Africa' [MeSH Terms] OR (mass tumoral' [All Fields] AND 'screening' [All Fields]) OR 'mass screening' [All Fields] OR 'cancer' [All Fields] OR 'cost in Africa' [MeSH Terms] OR ('mass tumoral' [All Fields] AND 'screening' [All Fields]) OR 'mass screening' [All Fields] OR 'cost' [All Fields] OR 'cancer in Africa' [All Fields]) AND ('cost' [MeSH Terms] OR 'cancer' [All Fields])} AND (Meta-Analysis [ptyp] OR systematic [sb]).

The articles we selected supported the evaluation of the cost of cancer in children aged 0 to 17 years in African countries. The inclusion criteria for the articles were (a) retrospective or prospective descriptive studies, (b) carried out in any type of health structure in Africa between March 2000 and March 2020 in which the subjects were (c) children (d) with cancer regardless of type, younger than 17 years, (e) included descriptive information on paediatric cancer management; we did not include the different islands of the African continent in the study. We first selected articles on the basis of their titles and then we searched the abstracts of those titles to screen focusing on one or more aspects of the financial cost of childhood cancer. Finally, we performed a manual search of the sources in the reference lists of articles we had selected that our online searches had not detected.

The following information was collected for each study: reference study, publication year, number of cancers, and direct and indirect cost data in US dollars. We based ourselves on the operational definitions of Heinrich (Hayhurst, 1932 ; Manuele, 2011 ; Rohani et al., 2015) who defines direct costs (CI) as current financial burdens attributable to disease acts, including hospitalization costs, medical care and laboratory costs), while indirect costs (CC) represent costs in terms of time and other resources (time paid and not by work, time lost, damage caused, interruption of production, social charges, loss of profits, housing).

The following information was collected for each study: study baseline, year of publication, number of cancers, and cost data in US dollars. The costs were estimated in US dollars, and findings were analysed in Stata 11.0 (StataCorp LLC).

3. Results

Of the 103 referenced entries (55 on PubMed, 32 on Google Scholar and 16 in the Cochrane Library), 18 studies were selected; the latter group could also generally be found in the PubMed database (Figure 1).

The 18 articles were classified by author, year, sample size, country and cancer unit (Table 1) and then sorted by number of publications on cancer care; there were three articles from Rwanda, Ivory Cost and DRC; two articles from Uganda and Ghana; and one each from Malawi, North Sudan, Benin, Tunisia, Nigeria, Malawi, Cameroon, Mali, Cameroon and Kenya.

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In most countries in Africa, paediatric cancer posed a significant economic burden on households. The disease cost varied from country to country with a cumulative average expenditure of US$1017.39 ± US$319.1 per year. Across countries, the majority of the cost for cancer management, 53.4%, was indirect costs in countries that did not have a health insurance system; in countries with a cancer financing system, 46.6% was direct costs, which was considered low.

The most reported economic burden was the difficulty paying the bills, although the greatest burden was the toll the disease itself took on the children with cancer. Other economic burdens concerned the time lost leading to absenteeism, transportation to inaccessible hospitals, inadequate care practices, lack of qualified oncologists and high-quality treatment and delayed diagnoses.

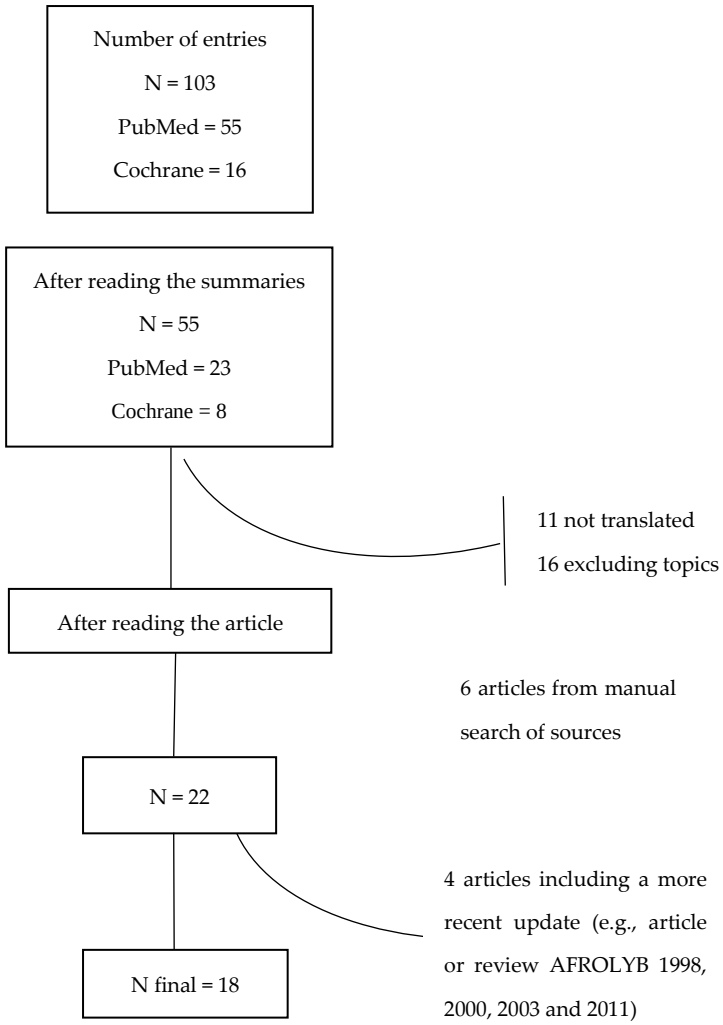

Figure 1. Flowchart of item selection

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Table 1. Summary of selected articles on the study of financial costs of paediatric cancer care in Africa

Authors	Country	Sample size	Financial costs (%)	
			IC	DC
Mjumbe et al., 2020	Democratic Republic of Congo (DRC) [4]	+(129)	43.1	56.9
Stulac et al. (2015)	Rwanda [8–9]	+(77)	77.1	22.9
Hesseling et al. (2009)	Malawi [10]	+(153)	30.8	69.2
Abuidris et al. (2008)	North Sudan [11]	++(201)	19	81.0
Akhivu (2009)	Benin [12]	+(91)	36.8	63.2
Missaoui et al. (2011)	Tunisia [13]	+(124)	71.2	28.8
Merimikwu (2005)	Nigeria [14]	++(291)	34.8	65.2
Denburg et al. (2019)	Uganda [15]	+(122)	45.8	54.2
Israels et al. (2018)	Ghana, Malawi et Cameroon [16]	+ (255)	46,3	53,7
Kabesha TA (2018)	Ivory Coast and DRC [17]	++(194)	56.9	43.1
Renner et al. (2018)	Ghana [18]	+(133)	38.8	61.2
Traoré et al. 2018	Mali [19]	+ (88)	37,1	62,9
Yao et al. 2019	Ivory Cost [20]	+ (169)	54,2	45,8
Doumbe et al. (2002)	Cameroon [21]	+(174)	61.2	38.8
Wakabi (2008)	Kenya and Uganda [22]	+(215)	49.7	50.3
Kanyamuhunga et al. (2015)	Ruanda [23]	+ (25)	40,2	59,8
Hendricks et al. 2011	Ivory Cost et DRC [24]	+ (19)	49	51
	Cumulative annual average		46,6	53,4

+Child subjects only.

++Child and adult subjects.

IC, indirect cost; DC, direct cost.

4. Discussion

Study characteristics

Between March 2000 and March 2020, we selected 18 articles that met the inclusion criteria post reviewing the titles and abstracts of 103 indexed articles. Only 18 of the 54 countries in Africa were represented: DRC (Mjumbe et al., 2020 ; Lukamba et al., 2018 ; Hendricks et al., 2011), Rwanda (Stulac et al., 2015 ; Neal et al., 2018 ; Kanyamuhunga et al., 2015), Malawi (Hesseling, 2009), North Sudan (Abuidris et al., 2008), Benin (Akhiwu et al., 2009), Tunisia (Missaoui et al., 2011), Nigeria (Meremikwu et al., 2005), Uganda (Fung et al., 2019 ; Wakabi, 2008), Ghana (Israels et al., 2018 ;Renner et al., 2018) , Malawi (Israels et al., 2018), Cameroon (Israels et al., 2018), Ivory Cost (Lukamba et al., 2018 ; Yao et al., 2019 ; Hendricks et al., 2011), Mali (Traoré et al., 2018), Cameroon (Doumbe et al.,

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2002) and Kenya (Wakabi, 2008). It is possible that unpublished studies were conducted in this region during the study period, but we believe the results might be approximately the same. Most of the 103 studies we originally identified concerned the epidemiologic profiles, with only some discussion of cancer costs among women in medical oncology units. The 18 published articles that we found in Africa in the above-mentioned time period by this systematic review were specific studies on the financial costs of cancer; the findings in seven of them revealed very high costs for cancer treatment across the continent.

Pediatric oncology units should include a well-established cancer registry and arrangements to reduce care costs. Unfortunately, the situation in Africa is still less than ideal. A number of countries in this region still lack dedicated cancer units, and patients who receive a cancer diagnosis face a sad fate including a significant economic burden. Many factors contribute to the lack of progress in oncology in Africa: limited governance and accountability, high political instability, natural disasters, underdeveloped infrastructures, and weaknesses in health systems (Metzger et al., 2003).

Financial costs of cancer care

Several researchers in the studies we identified reported high costs to manage cancer in oncology units, the presence of which varied from country to country in Africa (Doumbe et al., 2002). Costs were higher in countries that did not have a paediatric oncology department, and a significant financial burden of managing cancer was the indirect cost of travel by children and their caregivers to treatment units. In addition, during this study, we observed that the cost of care is on average US$109.5 per pay, whereas the cost of the same care is US$1537.8 in Angola (Lukamba et al., 2018).

The data from these studies show that in Africa, cancer care and diagnosis are expensive. The cost is the highest in the Democratic Republic of Congo (DRC) (Michel et al., 2008)[26], although in three pilot treatment units (in the capital, Kinshasa; Haut-Katanga in Lubumbashi and Bukavu in the east), families can receive a loan of US$1419 per year. In nearby Zambia and Rwanda, national subsidies for cancer patients significantly reduce the direct cost, to US$49 and US$61 per year, respectively, for total care costs of 49 USD and $ 61 per year (Michel et al., 2008).

Generally, the cost of care depends on the country, its standard of living, and its health policies. Countries with an oncology-centric system pay 10 times the average of countries without government subsidies (Knaul et al., 2011), and consistent with these findings, we found that cancer care in the Democratic Republic of the Congo costs 10 times more than in neighboring countries, Rwanda and Zambia. Financial inaccessibility is not usually a concern when household incomes are high. However, in the Democratic Republic of the Congo, the gross domestic product per capita per year was estimated at $276 in 2013 (Lukamba et al., 2018), and in this study, the average monthly household income was USD 13,34 and the average annual household income was US$1921.40; In the Democratic Republic of the Congo, healthcare care consumed 59.4% of the annual household income. Seven out of 10 households in the Democratic Republic of the Congo are poor (Michel et al., 2008). We also found that the heads of most households were self-employed (43.1%).

We identified that cancer poses a significant financial burden on families of children with cancer in Africa; 72.2% of households spend more than 59.2% of their income on care, which explicitly explains the high proportion of unmet cancer care needs in Africa (Knaul et al., 2011). We note in particular, however, that the situation in the DRC is more than catastrophic, given that food alone accounts for 62.3% of household expenditure (Metzger et al., 2003). Families that pay to treat children with cancer are likely to face long-term economic and social repercussions related to debt repayment (Akhiwu et al., 2009 ; Missaoui et al., 2011), and the situation is the same for Malawi, Cameroon (Hesseling and Wessels, 1995), Zimbabwe (Kerr and Midgley, 2010) and several other African countries where the costs of paediatric oncology care are beyond the reach of patients' families.

Faced with this situation, several states have introduced exemption and subsidy systems (Metzger et al., 2003). In Europe, for example, hospitalisation for cancer costs US$3,554.28 per year for one patient, of which only 20% is paid by the patient (Renner et

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al., 2018). In Mauritania, a flat rate system has been combined with user payment in public hospitals (Stulac et al., 2015). The Rwandan oncology center observed a significant increase in attendance when 90% of the cost of treatment was subtracted and a non-governmental organization funded completely free treatment (Hesseling and Wessels, 1995).

Through these different modes of financing health systems, different countries have succeeded in guaranteeing real access to pediatric oncology care (Ribeiro et al., 2016). The results of a survey conducted in Haiti revealed that the use increased when care was free; free preventive care saw 2.87 times more patients than fixed-price dispensaries with fixed prices (John and Ross, 2010). In the DRC, however, there is no health insurance system or user fee, although we note support from the GFAOP.

5. Conclusions

We identified with this systematic review we conclude that the economic burden of pediatric cancer care is very high in Africa, although we found significant heterogeneity in the 18 studies. When households have to pay for cancer care themselves, the cost is catastrophic, if not outright prohibitive. We believe that our findings are limited by the small number of countries that were represented and of studies on the costs of cancer care in Africa. We suggest that increasing knowledge on these topics would support making informed policies for financing healthcare systems in African countries.

Author Contributions: CKM and CKD were responsible for the concept, design, and literature search of the study. MN, CKM, and CKD collected data. CKM and CKD performed the statistical analysis. MN, CKM, CKD, BKI, DMK, and OLN drafted the manuscript. BKI, DMK and OLN supervised the study. All authors participated in the analysis and interpretation of the manuscript.

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