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RESEARCH

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Cost-effectiveness and budget impact of covering Burkitt lymphoma in children under Ghana's National Health Insurance Scheme

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Abstract

Background Childhood cancer is not a high priority in health care financing for many countries, including in Ghana. Delayed care seeking and treatment abandonment, often due to the financial burden of care seeking to families, are common reasons for a relatively low overall survival (OS) in low-and middle-income countries. In this study, we analyzed the cost-effectiveness of extending health insurance coverage to children with Burkitt lymphoma (BL) in Ghana.

Methods We developed a Markov model in Microsoft Excel to estimate the costs and effects of BL treatment when National Health Insurance Scheme (NHIS) was provided compared to the status quo where NHIS does not cover care for childhood cancer. The analysis was undertaken from the societal and health system (payer) perspective. Both costs (measured in $) and effects, measured using disability adjusted life years (DALYs), were discounted at a rate of 3%. The time horizon was a lifetime. Probabilistic sensitivity analysis was done to assess uncertainty in the measurement of the incremental cost-effectiveness ratio (ICER). A budget impact analysis was undertaken from the perspective of the NHIS.

Results In the base-case analysis, the intervention (NHIS reimbursed treatment) was less costly than current practice ($8,302 vs $9,558). The intervention was also more effective with less DALYs per patient than the standard of care (17.6 vs 23.33). The ICER was -$219 per DALY averted from societal perspective and $113 per DALY averted from health system perspective. The probabilistic sensitivity analysis showed that the intervention is likely to be both less costly and more effective than current practice in 100% of the 1,000 simulations undertaken.

Conclusion Providing health insurance coverage to children with BL is potentially cost-effective. The effectiveness and cost-savings relating to this strategy is driven by its positive impact on treatment initiation and retention. Based on this evidence, there has been a policy change where Ghana's NHIS has prioritized financing for cancer treatment in children.

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Introduction

There is disproportionate distribution of the global burden of childhood cancers; with four out of every five cases found in low-and middle-income countries (LMIC) [1, 2]. Worse still, the health systems of LMICs do not adequately support treatment to achieve high survival rates. Factors such as unavailability of essential medicines [3, 4], lack of access to effective diagnosis, and radiotherapy means childhood cancer continues to burden health systems and families of cancer patients in LMICs. To improve the treatment outcomes of childhood cancer, early case detection, intensive multimodal therapy and adequate supportive care are essential [5].

"BL is a common cancer in Ghana, which is thought to account for approximately two thirds of the 1300 new cases of childhood cancer each year, though this share has been declining in the last few decades [6, 7]. BL is a highly treatable but very aggressive form of non-Hodgkin's lymphoma, with treatments which have been shown to be cost-effective in Uganda [8]. Also, a study in Ghana found that childhood cancer treatment in very cost-effective [9].

Outcomes for children with cancer in Ghana and other sub-Saharan African countries are poor compared to high-income nations. Data from 1995 to 2009 across 67 countries found that in low and middle-income settings, overall survival (OS) is 5% to 60%, compared to 75% to 90% in high-income countries [10, 11]. In Ghana, paediatric oncology is limited to four healthcare facilities serving 15 million children [12]. The high cost of cancer care [13, 14] and limited awareness of childhood cancer contribute to delayed treatment, negatively affecting survival [15–17]. Furthermore, over 50% of children abandon treatment due to financial barriers, leading to incomplete care and worsened outcomes [16–22].

In Ghana, like many countries, adult cancers received priority over childhood cancers. Thus, as adult cancers such as breast and cervical cancers were covered under the National Health Insurance Scheme (NHIS), this contrasts the fact that, as at early 2021, there was no coverage for childhood cancer treatment under the NHIS [4]. Thus, patients seeking cancer treatment had to pay for healthcare services and essential cancer medicines out-of-pocket. This economic burden on caregivers and parents which often resulted in limited financial access to treatment for children suffering from cancer necessitated the push for NHIS coverage for childhood cancer by stakeholders. This policy shift was meant to alleviate the burden on families and help to improve outcomes because health insurance coverage increases care seeking and treatment retention [12].

In this study, we conducted a cost-effectiveness analysis and budget impact of health insurance for care and treatment of BL in Ghanaian children under the age of 15 years. The study was commissioned by the Ministry of Health as part of a larger health technology assessment (HTA) of providing national health insurance coverage for childhood cancers in Ghana. While the study was meant to inform policy on financing of childhood cancer in Ghana, it could also be relevant to other LMICs.

Methods

We developed a Markov model (Fig. 1) in Microsoft Excel to compare the cost-effectiveness of extending health insurance coverage to children with BL, compared to the status quo where BL is not covered by the NHIS. In the current scenario, care is provided at a fee by the government. Patients cover their own costs of transportation, inpatient care (including meals and lodging), diagnostics, and medications. Some financial aid to support treatment is provided to patients by private philanthropic agencies such as the World Child Cancer and the Ghana Parents' Association for Childhood Cancer. Local faith-based organizations also provide financial assistance to low-income families for transportation, meals, and medical services. Nevertheless, patients bear the brunt of the financial burden for paediatric cancer care.

The analysis is comparing the status quo against a strategy (the intervention) where NHIS coverage is extended to finance the costs of all health services at the point of care such as inpatient care (including meals and lodging), diagnostic tests and medications, but

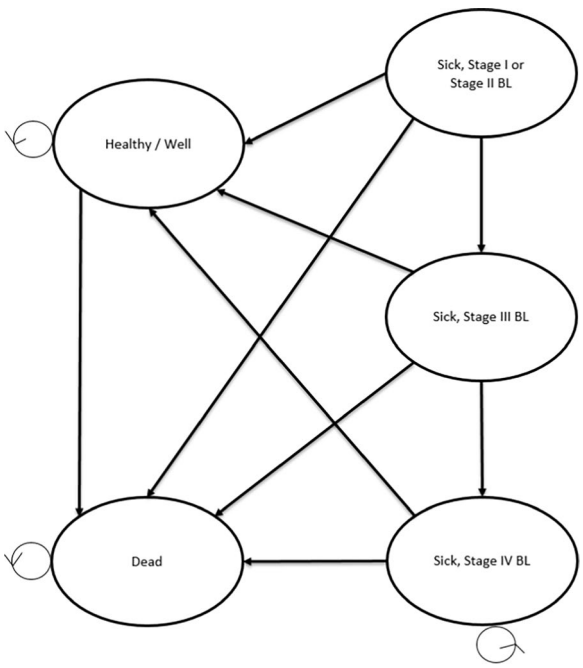


Fig. 1 Markov model of treatment for Burkitt's lymphoma

costs of accessing care such as transportation are not included from the health system perspective.

The baseline population was all patients below the age of 15 years with a BL diagnosis treated in a health facility. We assumed that 22% of all childhood cancers were BL and 30% of these cases would be detected and treated at a health facility [6, 13]. The average age of disease onset was 7 years [13, 14].

In the model, patients start in either one of three disease states: Stage I/II, Stage III or Stage IV BL; and then transition to another disease stage, become healthy or die. Disease progression is unidirectional, indicating that patients can only move from a lower to higher stage of disease and not vice-versa. State transitioning is dependent on the likelihood to abandon treatment, combined with the stage-dependent effectiveness of treatment. Due to limited data on disease recurrence post successful treatment, we assumed that patients in the well state did not transition back to being sick. The model operates under the assumption that 1-year event-free survival is a valid estimation of long-term overall survival, as BL has very poor survival rates for individuals who progress or relapse. The distribution of cases at onset was projected as follows: 11% were in Stage I/II, 78% were in Stage III and 10% in Stage IV; this distribution was based on data provided by Oncologists at Korle Bu Teaching Hospital in Ghana and data in the literature [13].

The model used a cycle length of one year (with half cycle correction). Due to the aggressive nature of BL, we assumed that all health-related outcomes occur within a year [15]. The time horizon for this analysis was a lifetime, based on Ghana's life expectancy at birth.

Table 1 shows the treatment regimen for childhood BL used in the model. Treatment for Stages I, II and III involves a low-intensity combination therapy with cyclophosphamide and low-dose methotrexate. Stage IV treatment uses a modified version of a mature B-cell protocol without Rituximab.

The model uses a treatment abandonment rate of 25% [6, 16], and we estimated that NHIS coverage would lead to a 50% reduction in treatment abandonment, based on a study of paediatric cancer patients in Kenya [17]. Both the treatment abandonment rate and reduction in treatment were applied uniformly across all cancer stages.

We estimated the annual cost per patient associated with treatment and management of BL from a societal and health system perspectives. The costs included all aspects of managing cancer, considering patient costs related to transportation, diagnostics, medications as well as productivity losses associated with treatment. However, the health system perspective excluded transportation cost and productivity losses to patients/caregivers.

Table 1 Burkitt's Lymphoma Treatment protocol in Ghana Source: Offor et al. [21], Korle Bu Teaching Hospital

Tumor stage	Course of treatment
Stages I, II & III	A pre-phase dose of IV cyclophosphamide 1400 mg/m2 with IT methotrexate, followed by a combination chemotherapy consisting of 6 cycles (cyclophosphamide, vincristine and doxorubicin alternating with cyclophosphamide, vincristine and cytarabine every 2 weeks) with IT methotrexate given during the first 3 courses
Stage IV	For bone marrow involvement a modified version of a mature B-cell protocol for high income countries without rituximab is used, and inclusive of four cycles of maintenance therapy, following reduction, induction and consolidation phases of therapy. For CNS disease, additional intrathecal therapy is included until cerebrospinal fluid (CSF) cytology is negative

The cost of baseline labs, diagnostic tests and discharge tests were based on hospital fees and NHIS tariffs associated with each individual test given to a patient. Baseline laboratory tests undertaken at first diagnosis include full blood count, uric acid, hepatitis C and HIV tests. These are followed by confirmatory tests, which include chest x-ray, abdominal ultrasound, CT scan and bone marrow aspiration tests. Costs of medication were derived by estimating the total medicines used by patients when completing the entire stage-dependent treatment regimen. For height and weight dependent dosing, we used an average height of 118 cm, 20.60 kg for body weight, and 0.822 m^2 for body surface area, based on average height and weights for children aged 7–8 years in Nigeria, due to a lack of Ghana-specific data. Family costs as well as the productivity losses associated with premature death were based on a study by Dawson et al. estimating the costs associated with informal caregiving for children with lymphoma attending a tertiary hospital in Ghana [18]. The study estimated direct costs to the family such as transportation and food, and indirect costs associated with time lost while taking care of a sick relative. Productivity losses were estimated using the human-capital approach (the daily minimum wage in Ghana multiplied by the number of working days in a year) [18]. We also included costs of follow-up visits post-treatment (including physician time and family costs). According to the BL treatment protocol, follow-ups are conducted monthly for 6 months after initial discharge, then every three months for two years, thereafter every six months for 5 years; and then once a year afterwards up to 8 years.

The health outcome measure used was disability-adjusted life years (DALYs), which are the sum of the years of life lost (YLL) from a disease, and the quality-adjusted years lived with disease (YLD) [19]. To calculate

DALYs, we assumed the following: mean disease duration was 1 year; the average age at onset of BL was 7 years [20, 21]; life expectancy at birth of 64.1 years; we used the following disability weights—0.288 for BL Stages I and II, and 0.451 for BL Stages III and IV [22]. The annual probability of death from BL was estimated to be 0.25 for Stages I and II, and 0.2857 for Stages III and IV [23]. DALYs were not age-weighted. Future values of costs and health effects were discounted at a rate of 3% [24].

Cost-effectiveness was determined by means of the incremental cost-effectiveness ratio (ICER) calculated as cost per DALY averted. The threshold measure used to determine cost-effectiveness was a cost per DALY averted less than 0.5 times Ghana's GDP per capita ($1,103). The GDP per capita of Ghana in 2020 was $2,205 [25]. When converting from US dollars to Ghana Cedi, the exchange rate for 30 June 2021 according to the US Department of Treasury was used where 5.85 Ghana Cedi = 1 US dollars [26]. All costs are reported in 2021 US dollars.

To assess the robustness of the model and understand how uncertainty in parameters may influence outcomes, we performed a probabilistic sensitivity analysis which used a Monte Carlo Simulation with 1000 draws for each parameter, where parameter-estimates were assigned from their respective probability distribution. Beta distributions were fitted for probability parameters using point estimates and standard errors. Lognormal distributions were fitted for relative risks using point estimates and their confidence intervals. The gamma distribution was used for costs and DALYs.

A budget impact analysis was undertaken from the perspective of the NHIS, to estimate the annual costs of extending insurance coverage for the treatment cost of children with BL for the coming five years. Only direct cost to the NHIS, as estimated for the economic evaluation, were considered in this analysis. We corrected for half-cycle and accounted for inflation following WHO CHOICE methods (rate: 0.05 per year). A scenario-analysis was performed, to project annual costs borne by the NHIS at three reimbursement rates:

1) Baseline: Using the current NHIS tariff rate for the cost of labs and tests (assuming Bone Marrow Aspiration (BMA) & Biopsy/Fine Needle Aspiration Cytology (FNAC) are reimbursed on the ratio of NHIA to hospital-fee),
2) NHIS covers 100% of the fees charged by Korle Bu Teaching Hospital (KBTH) for the cost of labs and tests as the tariff rate,
3) NHIS covers 65% of the fees charged by KBTH for the cost of labs and tests as a tariff rate.

Lastly, we performed one-way sensitivity analysis, where one parameter at a time was changed, for all three coverage-scenarios to identify potential cost-drivers. Results are presented in a table and a tornado-diagram.

Results

Table 2 presents the base-case cost-effectiveness analysis. From the societal perspective, estimated cost for current practice is $9,558, compared to $8,302 for the NHIS-reimbursed treatment. The difference between the costs of the intervention (NHIS-reimbursed treatment) and the standard of care (current practice) is $1,256, i.e., the intervention is less costly and potentially leads to cost-savings amounting to $1,256 per patient. The intervention is also potentially more effective as it averts more DALYs per patient than the standard of care (17.6 vs 23.33). As the NHIS-reimbursed treatment is both more effective and less costly, the intervention is always preferred. Also, from the health system perspective, the intervention costs $647 per patient and averts more DALYs per patient than the current practice (17.6 vs 23.33).

Table 2 Results of the cost-effectiveness analysis

Figure 2 presents a scatter plot of incremental cost-effectiveness ratios (ICERS) derived by running 1000 simulations of the cost-effectiveness analysis. All ICERs plotted on the graph fall below the horizontal axis (DALYs averted) and to the right of the vertical axis ($ costs), implying that the intervention (NHIS-reimbursed treatment) is both cheaper and more effective than the standard of care (current practice). In other words, the NHIS-reimbursed treatment dominates treatment with Current Practice in 100% of the 1000 simulations and can thus be considered to be

Table 2 Results of the cost-effectiveness analysis from Societal and NHIS Perspectives

Perspective	Strategy	Cost per patient	DALYs per patient	ICER (Incremental cost per incremental DALY averted)
Societal	Current practice	$9,558	23.33	– $219
	NHIS-reimbursed treatment	$8,302	17.60	
NHIS/health system	Current practice	$0	23.33	$113
	NHIS-reimbursed treatment	$647	17.60	

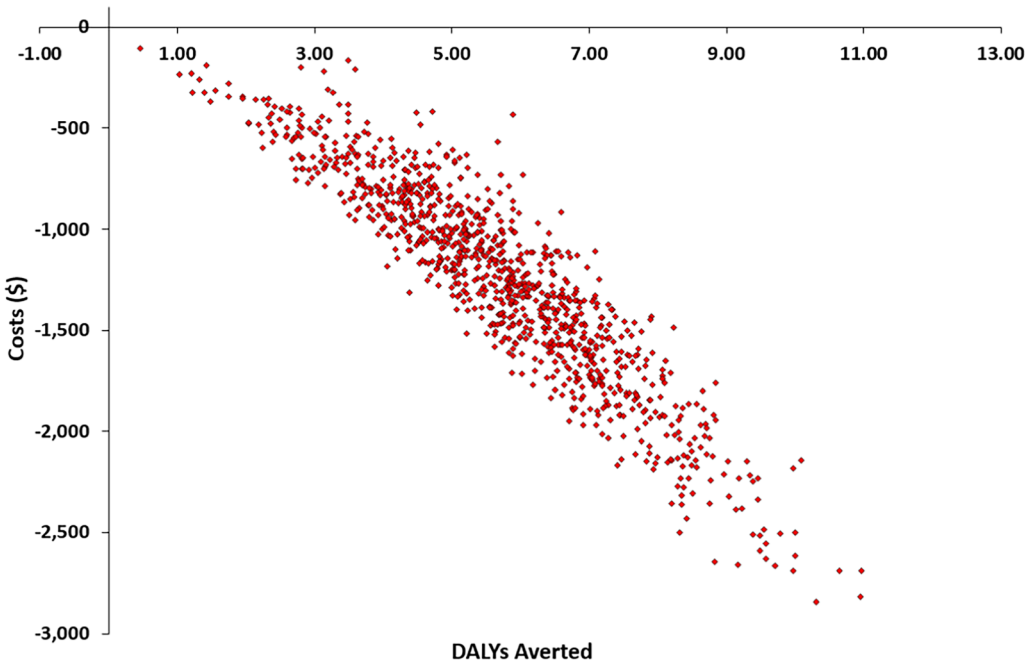


Fig. 2 Treatment with NHIS reimbursement compared to current practice

cost-effective. Moreover, considering the ICER of $113 per DALY averted from the health system perspective and – $219 per DALY averted from the societal perspective against a cost-effectiveness threshold of 50% of GDP per capita of Ghana ($1,103), the intervention is cost-effective.

Budget impact analysis

Base-case results

Figure 3 presents the results of the base-case Budget Impact Analysis. The cost to the NHIS estimated in years 1 through 5 are as follows: $83,871 in year 1, $185,001 in year 2, 215,800 in year 3, $227,822 in year 4, and $239,256

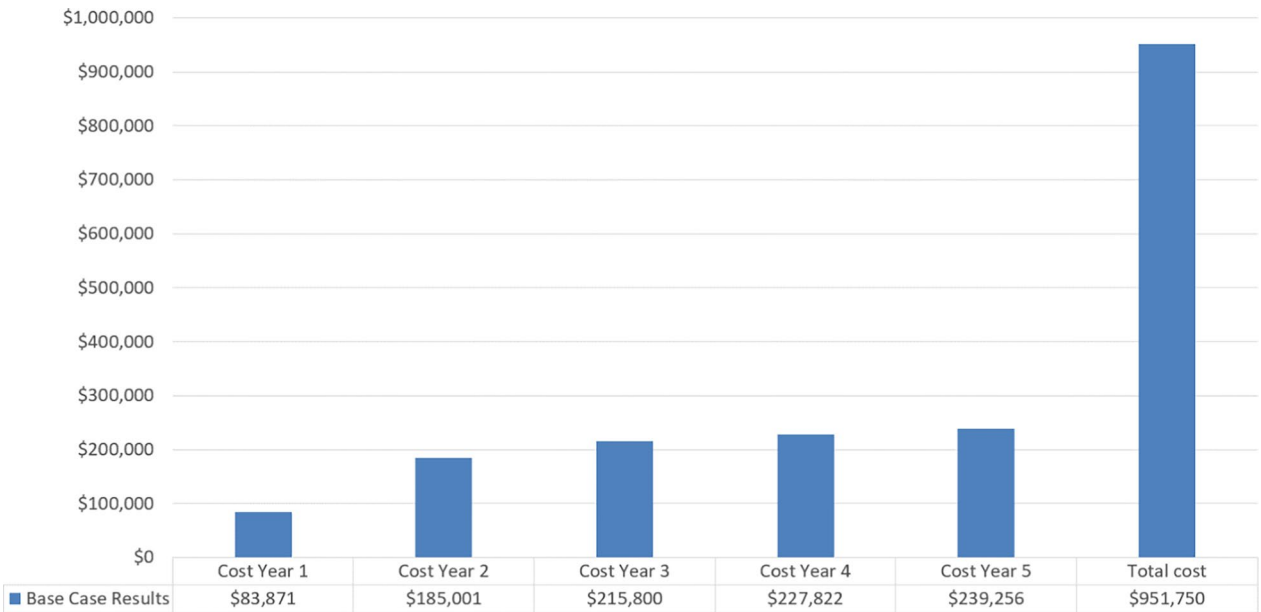


Fig. 3 Base-Case results of Budget Impact Analysis

in year 5. This leads to an estimated total budget impact to the NHIS of $951,750 in the first 5 years should BL be added to the NHIS reimbursement list.

Figure 4 presents the results of the scenario analysis, showing the projected annual costs of treatment that are likely to be borne by the NHIS at three reimbursement scenarios over a period of 5 years. In all the scenarios, the costs are additional to the NHIS existing budget. Thus, the results showed a total expected NHIS budget impact of $951,750 under Tariff scenario 1 (base-case scenario), $1,618,267 under Tariff scenario 2 (100% NHIS coverage), and $1,282,860 under Tariff Scenario 3 (65% NHIS coverage). Compared to Tariff Scenario 1, Tariff Scenario 3 poses an incremental difference of $331,110. Scenario 2 poses an incremental difference of $335,407 compared to scenario 3. All the Tariff scenarios show the lowest cost in the first year and an increasing cost in each subsequent year.

The results of the one-way sensitivity analysis for all Tariff scenarios can be seen in Table 3. The sensitivity analysis showed whether change in these parameters leads to a decrease or increase in total cost.

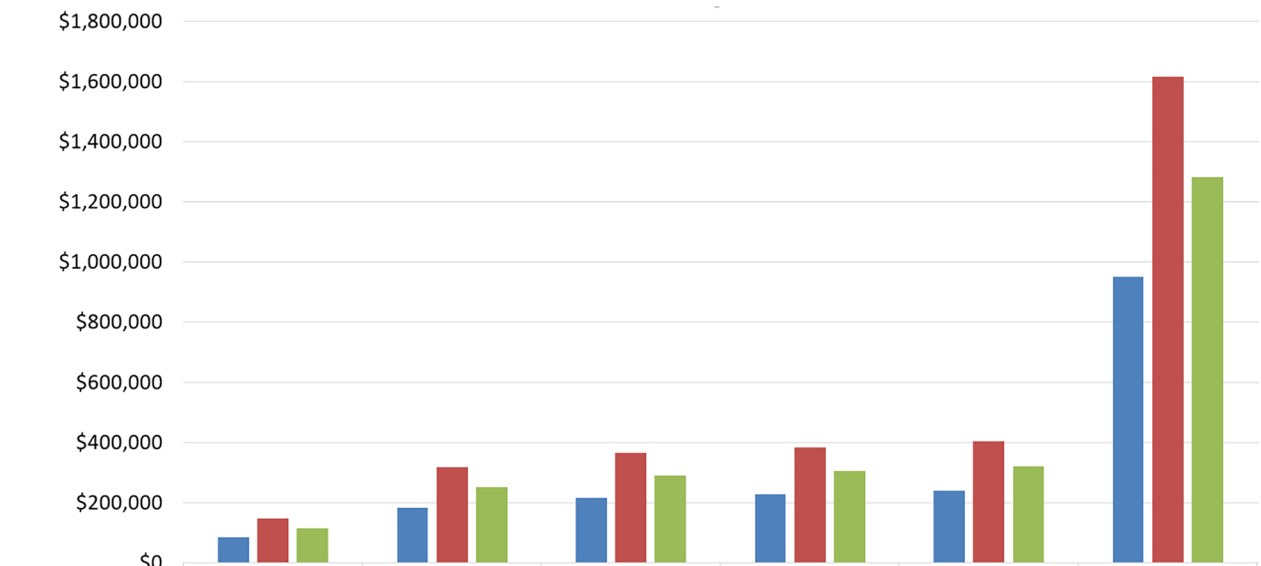
For the parameters "Resources used when a patient abandons treatment" and "proportion of patients who abandon treatment", the total cost decreases when we assume values greater than the base-case scenario, and the total cost increases when we assume values less than the base-case scenario. The type of relationship between these parameters and the total cost, where a decrease in one value leads to an increase in the other and vice versa can be defined as a negative relationship.

For the parameters "Proportion of patients who seek treatment", "Annual rate of increase in treatment seeking", and "Proportion of patients diagnosed with Stage IV disease", the total cost increases when we assume values greater than the base-case scenario, and the total cost decreases when we assume values less than the base-case scenario. The type of relationship between these parameters and the total cost, where an increase in one value leads to an increase in the other and vice versa can be defined as a positive relationship.

Figure 5 further presents the results of the one-way sensitivity analysis through a visual medium via a tornado diagram. This figure illustrates the degree of sensitivity of the results to each individual selected parameter. The total cost is most sensitive to change in "proportion of patients who seek treatment", followed in descending order by "proportion of patients who abandon treatment", "the annual rate of increase in treatment seeking", "resources used when a patient abandons treatment", and "proportion of patients diagnosed with stage IV disease".

Discussion

Our model predicts that providing health insurance coverage to paediatric patients with BL is potentially cost-effective. In this study, we use a threshold of 50% of GDP



	Cost Year 1	Cost Year 2	Cost Year 3	Cost Year 4	Cost Year 5	Total cost
Tariff Scenario 1	$83,871	$185,001	$215,800	$227,822	$239,256	$951,750
Tariff Scenario 2	$146,572	$317,528	$364,942	$384,958	$404,268	$1,618,267
Tariff Scenario 3	$115,030	$250,845	$289,885	$305,877	$321,223	$1,282,860

Fig. 4 Results of the scenario analysis for budget impact

Table 3 One-way sensitivity of the results to selected parameters under three Tariff scenarios

Model parameter	Value in model	Sensitivity analysis	Tariff scenario 1 (base case)	Tariff scenario 2 (100% coverage)	Tariff scenario 3 (65% coverage)
Resources used when a patient abandons treatment	50%	0%	$1,066,144	$1,620,360	$1,420,588
		25%	$1,001,402	$1,671,201	$1,334,174
		75%	$902,099	$1,565,333	$1,231,545
Proportion of patients who abandon treatment	0.255	0.000	$1,132,383	$1,873,974	$1,501,511
		0.100	$1,059,610	$1,771,187	$1,413,541
		0.682	$687,234	$1,239,624	$960,505
Proportion of patients who seek treatment	0.3	0.1	$317,250	$539,422	$427,620
		0.5	$1,586,250	$2,697,112	$2,138,100
		1.0	$2,917,045	$4,956,935	$3,930,406
Annual rate of increase in treatment seeking	0.05	0.00	$875,114	$1,487,080	$1,179,122
		0.10	$1,034,886	$1,760,662	$1,395,437
		0.15	$1,124,914	$1,914,947	$1,517,390
Proportion of patients diagnosed with Stage IV disease	0.1				
		0.050	$923,346	$1,590,309	$1,254,733
		0.150	$982,366	$1,648,401	$1,313,177

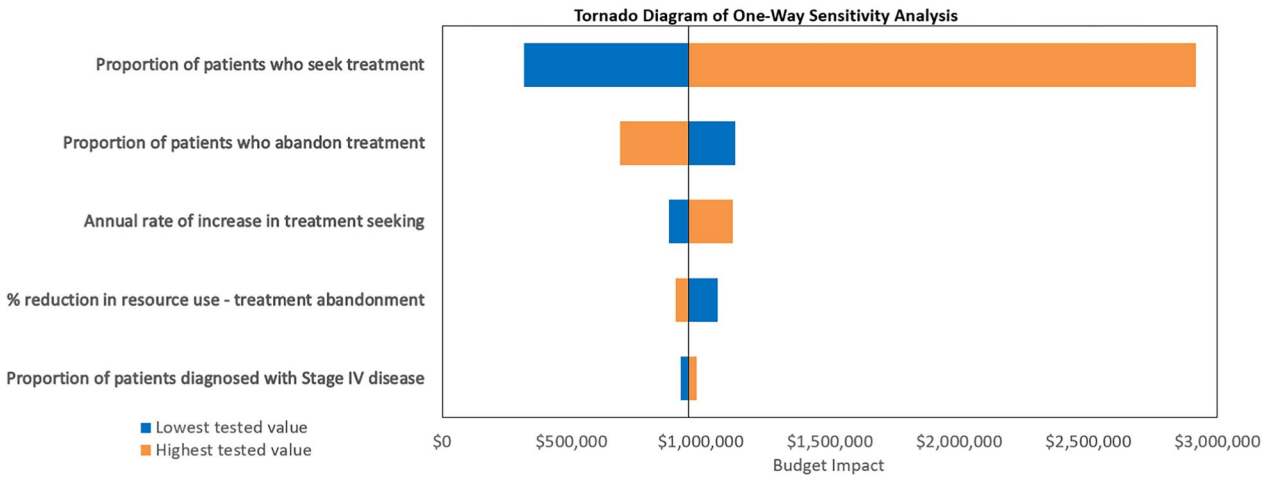


Fig. 5 Tornado diagram of the one-way sensitivity analysis of selected parameters

per capita. While Ghana has yet to establish a specific threshold for assessing the value of an intervention, and the previous WHO recommendation of 1–3 times GDP per capita is no longer considered applicable [27], recent econometric modelling that takes into account opportunity costs and income elasticity suggests that the cost-effectiveness thresholds for Ghana may fall between 4 and 40% of GDP per capita ($88.24–$882.40) [28]. Likewise, previous studies in Ghana have used a more conservative threshold of 50% GDP per capita ($1103) [29, 30], which is significantly lower than the WHO recommendation. The effectiveness and cost-saving of NHIS coverage for BL is driven by the NHIS coverage impact on treatment initiation and retention. Delays in treatment seeking and treatment abandonment, associated with high costs of care, have been shown to negatively impact the overall survival in childhood cancer. Extending health insurance coverage to this group of patients can help to ease the financial burden of healthcare [17], and this is supported by our study.

This study confirms the cost-effectiveness of treatment for BL as reported by a previous study in Uganda [8]. Our results highlight that, compared to out-of-pocket payments for BL treatment in Ghana, treatment is more cost-effective when paid under the NHIS. This finding points to the significant role that adequate financing plays in the treatment cycle of BL. Previous studies have highlighted the fact that treatment abandonment was a

major barrier to improved treatment outcomes for childhood cancers [3, 31]. Therefore, when financing out of pocket is no more a barrier to families, they are willing to take their sick children to hospital which helps with early detection and improve treatment outcomes.

In this study, cost of treatment per patient was $9,558 for non-insurance payment and $8,302 for NHIS-reimbursed treatment. This cost of treatment is within the $2400 to $31,000, that is reported in a cost-effectiveness study on childhood cancers in four sub-Saharan African countries (Kenya, Nigeria, Tanzania, and Zimbabwe) [32]. The variances in costs in the countries have been attributed to center size, case mix, drug prices, and admission practices [32]. These factors may equally explain the variation of the cost of treatment between Ghana and the countries above. Further, the source of variation between the cost of treatment per patient in Ghana and other countries even though not obvious, may be attributed to the specific case of BL being relatively cheaper to treat compared to other childhood cancer generally, as reported by Githang'a et al. [32].

In general, treating and managing childhood cancer has been shown to be highly cost-effective across some settings in sub-Saharan Africa [9, 32]. One of the reasons for this is that a high number of life years are potentially gained from saving a young life (e.g., more than 50 life years gained per child on average). This shows the importance of supporting effective treatments and mechanisms for managing childhood cancer. In our study, we evaluated the impact of providing health insurance, so that affected children can have access to much needed care. This has been advocated by many groups who point to the fact that the costs of childhood cancer are prohibitive and lead many families to either delay care or abandon it once treatment has commenced [31, 33, 34]. Providing health insurance to paediatric cancer patients has been shown to be effective in increasing access to care, limiting treatment abandonment, leading to an increase in overall survival [12]. This assumption that we made about the success of insurance coverage in our study did improve the overall effect and cost-effectiveness of the intervention. However, the sensitivity analysis showed that this assumption was not highly sensitive to changes.

Our analysis has shown that providing health insurance cover to BL patients is potentially cost-effective in Ghana. This intervention can help to achieve desirable treatment outcomes and prevent avoidable deaths of children by increasing access to care and treatment retention. However, increasing access to care may not always be as easy in real world settings and several factors must be taken into consideration. In Ghana for example, there are not many facilities providing cancer treatment. Care is mainly provided at four main teaching hospitals which may not be easily accessible to patients from remote areas of the country. Patients must travel long distances to access treatment, and this contributes to high costs to the family. Providing insurance cover may thus only partially alleviate patient costs.

Further, much needs to be done to generate awareness among patients, teaching them about cancer and to generally improve treatment seeking behaviour. These 'awareness raising' costs can be high but have not been considered in this study. However, in all likelihood, the intervention is still likely to be cost-effective, due to the increased overall survival of children being treated for cancer. In additional analyses, we showed that even if the study perspective was restricted to the NHIS only, the intervention would still most likely be very cost-effective.

The costs to the NHIS are expected to be between $951,000 and $1,620,000 over a five-year period, i.e. between $0.03 and $0.05 per capita (based on the total population of Ghana). This is about 0.5–0.9% of the total NHIS claims payment made in 2022 ($173,333,33) [35].

Limitations

There are some limitations with our study. Firstly, data was triangulated from various sources (i.e., the effect of health insurance on treatment abandonment, some population characteristics, and treatment effects) when data from Ghana was not available. We tried to use local data when available and tested parameter uncertainty using sensitivity analyses; with results indicating that our model and assumptions were robust.

The costs of treating and managing childhood cancer presented in this study could be an underestimate. Even though we endeavoured to provide costs from a societal perspective, there are a lot of other costs beyond access to care that families could incur that are not considered here, for example the funeral expenses. In addition, the intangible costs related to grief and human loss cannot be quantified. These issues could be investigated in future research. We are confident however, that we have provided an acceptable cost estimate, which fall within the range of what has been shown to be the costs of managing childhood cancer in sub-Saharan Africa.

In this study, only one childhood cancer was considered in this evaluation and thus both the costs and benefits highlighted are minimal. However, BL accounts for a significant proportion of childhood cancers and the findings given in this report can be extended to other cancers. However, to better inform the government and the NHIS, further analyses should be conducted to outlay the full cost implications of changing the financing policy for childhood cancer in general.

Policy implications

Our study provides useful information that can inform policy on managing childhood cancer in Ghana and other sub-Saharan African countries. The study supports increasing calls from stakeholders for the funding of childhood cancers, which are often overlooked in comparison to adult cancers and other non-communicable diseases. This is despite the increasing attention that is paid to non-communicable diseases and cancer in general. Indeed, while medicines indicated for childhood cancers are available on the Medicines List of the NHIS in Ghana for other cancers, childhood cancer treatment is not considered for reimbursement. There has been a policy shift regarding reimbursement following the presentation of the results of this study to the HTA-Technical Working Group of the Ministry of Health and follow through action by the National Health Insurance Authority. Childhood cancers are now included in the benefit package of the NHIS [36].

Ghana's strategy for HTAs, defines strategic action for follow through on recommendations made in HTA reports. The emerging policy actions emanating from the BL HTA report have been structured into the Childhood Cancer HTA implementation project, launched in Ghana in April 2022, to ensure critical, supporting and necessary actions are taken even beyond reimbursements.

In many ways, the findings of this assessment also point to the need for overall improvement in the health system. Treatment seeking appears to be a challenge that needs to be urgently addressed. A lot of cancers are detected at advanced stages, which negatively impacts survival. Thus, policy should encourage both early treatment and retention. The role of stakeholders, particularly at the community level should be taken into consideration, especially in relation to the government expanding strategy for cancer control.

Conclusion

This evaluation demonstrates the cost-effectiveness and financial implication of extending health insurance to BL in Ghanaian children. BL coverage under the NHIS coverage was found to be cost-effective from the NHIS perspective and cost-saving from the societal perspective. Moreover, this study has shown that coverage under the NHIS would lead to improved health outcomes of children with BL. Our analysis shows that the government and society in general can benefit from investment in BL and most likely childhood cancers generally.

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Author contributions

Conceived and designed the experiments: LC DP BA LD LFH RO GG. Performed the experiments: LC DP GG LFH. Analyzed the data: LC DP GG LFH. Contributed reagents/materials/analysis tools: BA IA JA MGL LD RAM WO FR MG JN. Wrote the paper: RO DP LFH GG BA IA JA MGL FR MG JN LC. All authors read and approved the paper.

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Availability of data and materials

Datasets including model used will be made available upon reasonable request to the corresponding author.

Declarations

Ethics approval and consent to participate

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Steliarova-Foucher E, Colombet M, Ries LAG, Moreno F, Dolya A, Bray F, et al. International incidence of childhood cancer, 2001–10: a population-based registry study. Lancet Oncol. 2017;18(6):719–31.
2. Lubega J, Kimutai RL, Chintagumpala MM. Global health disparities in childhood cancers. Curr Opin Pediatr. 2021;33(1):33–9.
3. Boateng R, Renner L, Petricca K, Gupta S, Denburg A. Health system determinants of access to essential medicines for children with cancer in Ghana. BMJ Glob Health. 2020;5(9): e002906.
4. Mensah KB, Mensah ABB, Bangalee V, Padayachee N, Oosthuizen F. Evaluating essential medicines for treating childhood cancers: availability, price and affordability study in Ghana. BMC Cancer. 2021;21(1):1–9.
5. Denburg A, Wilson MG, Johnson Si, Kutluk T, Torode J, Gupta S. Advancing the development of national childhood cancer care strategies in Latin America. J Cancer Policy. 2017;12:7–15.
6. Gouveia MH, Bergen AW, Borda V, Nunes K, Leal TP, Ogwang MD, et al. Genetic signatures of gene flow and malaria-driven natural selection in sub-Saharan populations of the 'endemic burkitt lymphoma belt.' PLoS Genet. 2019;15(3): e1008027.
7. Emmanuel B, Kawira E, Ogwang MD, Wabinga H, Magatti J, Nkrumah F, et al. African burkitt lymphoma: age-specific risk and correlations with malaria biomarkers. Am J Trop Med Hyg. 2011;84(3):397.
8. Denburg AE, Laher N, Mutyaba I, McGoldrick S, Kambugu J, Sessle E, et al. The cost effectiveness of treating Burkitt lymphoma in Uganda. Cancer. 2019;125(11):1918–28. https://doi.org/10.1002/cncr.32006.
9. Renner L, Shah S, Bhakta N, Denburg A, Horton S, Gupta S. Evidence from ghana indicates that childhood cancer treatment in Sub-Saharan Africa is very cost effective: a report from the childhood cancer 2030 network. J Glob Oncol. 2018;4(4):1–9.
10. Ribeiro RC, Steliarova-Foucher E, Magrath I, Lemerle J, Eden T, Forget C, et al. Baseline status of paediatric oncology care in ten low-income or mid-income countries receiving My Child Matters support: a descriptive study. Lancet Oncol. 2008;9(8):721–9.
11. Allemani C, Weir HK, Carreira H, Harewood R, Spika D, Wang XS, et al. Global surveillance of cancer survival 1995–2009: analysis of individual data for 25,676,887 patients from 279 population-based registries in 67 countries (CONCORD-2). Lancet. 2015;385(9972):977–1010.
12. Martijn HA, Njuguna F, Olbara G, Langat S, Skiles J, Martin S, et al. Influence of health insurance status on paediatric non-Hodgkin's lymphoma treatment in Kenya. BMJ Paediatr Open. 2017;1(1): e000149.
13. Lavu E, Morewaya J, Maraka R, Kiromat M, Ripa P, Vince J. Burkitt lymphoma in papua new guinea–40 years on. Ann Trop Paediatr. 2005;25(3):191–7.
14. Graham BS, Lynch DT. Burkitt Lymphoma. StatPearls. 2021.
15. Moormann AM, Skiles J, Otieno J, Buckle GC. Article in Blood and Lymphatic Cancer Targets and Therapy. 2014.
16. Saleh K, Michot JM, Camara-Clayette V, Vassetsky Y, Ribrag V. Burkitt and burkitt-like lymphomas: a systematic review. Curr Oncol Rep. 2020. https://doi.org/10.1007/s11912-020-0898-8.
17. Orem J, Mbidde EK, Lambert B, De Sanjose S, Weiderpass E. Burkitt\'s lymphoma in Africa, a review of the epidemiology and etiology. Afr Health Sci. 2007;7(3):166–75.
18. Jaffe ES, Barr PM, Smith SM. Understanding the new WHO classification of lymphoid malignancies: why it's important and how it will affect practice. Am Soc Clin Oncol Educ Book. 2017;37(37):535–46.
19. Mbulaiteye SM, Anderson WF, Ferlay J, Bhatia K, Chang C, Rosenberg PS, et al. Pediatric, elderly, and emerging adult-onset peaks in Burkitt's Lymphoma incidence diagnosed in four continents, excluding Africa. Am J Hematol. 2012;87(6):573–8.
20. Olaniyi JA. Burkitt lymphoma: a review. 2012. https://doi.org/10.4172/scientificreports.337
21. Offor UT, Akyea RK, Neequaye JE, Renner LA, Segbefia CI. The changing clinical pattern of endemic Burkitt lymphoma in Western Africa: experience from a tertiary center in Ghana. Pediatr Blood Cancer. 2018;65(10): e27275. https://doi.org/10.1002/pbc.27275.
22. Salomon JA, Haagsma JA, Davis A, de Noordhout CM, Polinder S, Havelaar AH, et al. Disability weights for the global burden of disease 2013 study. Lancet Glob Health. 2015;3(11):e712–23.
23. Molyneux E, Schwalbe E, Chagaluka G, Banda K, Israels T, Depani S, et al. The use of anthracyclines in the treatment of endemic Burkitt lymphoma. Br J Haematol. 2017;177(6):984–90. https://doi.org/10.1111/bjh.14440.
24. Ferry JA. Burkitt's Lymphoma: clinicopathologic features and differential diagnosis. Oncologist. 2006;11(4):375–83.
25. World Bank. GDP per capita—Ghana. 2021. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=GH. Accessed 23 Feb 2022.
26. Treasury Reporting Rates of Exchange | U.S. Treasury Fiscal Data. https://fiscaldata.treasury.gov/datasets/treasury-reporting-rates-exchange/treasury-reporting-rates-of-exchange. Accessed 24 Dec 2024.
27. Leech AA, Kim DD, Cohen JT, Neumann PJ. Use and misuse of cost-effectiveness analysis thresholds in low- and middle-income countries: trends in cost-per-DALY studies. Value Health. 2018;21(7):759–61.
28. Woods B, Revill P, Sculpher M, Claxton K. Country-level cost-effectiveness thresholds: initial estimates and the need for further research. Value Health. 2016;19(8):929–35.
29. Owusu R, Mvundura M, Nonvignon J, Armah G, Bawa J, Antwi-Agyei KO, et al. Rotavirus vaccine product switch in Ghana: an assessment of service delivery costs, switching costs, and cost-effectiveness. PLOS Global Pub Health. 2023;3(8): e0001328. https://doi.org/10.1371/journal.pgph.0001328.
30. Ibrahim AM, Owusu R, Nonvignon J. Sustainability of pneumococcal conjugate vaccination in Ghana: a cost-effectiveness analysis in the context of donor transition. Front Pub Health. 2024;12:1383668.
31. Renner LA, McGill D. Exploring factors influencing health-seeking decisions and retention in childhood cancer treatment programmes: perspectives of parents in Ghana. Ghana Med J. 2016;50(3):149–56.
32. Githang'a J, Brown B, Chitsike I, Schroeder K, Chekwenda-Makore N, Majahasi F, et al. The cost-effectiveness of treating childhood cancer in 4 centers across sub-Saharan Africa. Cancer. 2021;127(5):787–93.
33. Dawson CP, Aryeetey GC, Agyemang SA, Mensah K, Addo R, Nonvignon J. Costs, burden and quality of life associated with informal caregiving for children with Lymphoma attending a tertiary hospital in Ghana. Int J Care Coord. 2021;23(4):165–72. https://doi.org/10.1177/2053434520981357.
34. Chagaluka G, Afungchwi GM, Landman L, Njuguna F, Hesseling P, Tchintseme F, et al. Treatment abandonment: a report from the collaborative African network for childhood cancer care and research—CANCaRe Africa. Pediatr Blood Cancer. 2021;68(12): e29367.
35. Ghana News Agency. Ghana News Agency. NHIS paid GH₵1.014 billion claims in 2022. 2023. https://gna.org.gh/2023/03/nhis-paid-gh%C2%A21-014-billion-claims-in-2022/. Accessed 26 Dec 2024.
36. National Health Insurance Authority. National Health Insurance Authority. Childhood Cancers included in NHIS Benefit Package. 2021. https://www.nhis.gov.gh/News/childhood-cancers-included-in-nhis-benefit-package-5365. Accessed 11 Apr 2022.

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