Supplementary material

Table S1. Childhood cancer incidence distribution in Tikur Anbessa Specialized Hospital (TASH), 2018–2019

Diagnosis	**Share: N (%)***
Acute lymphoblastic leukemia	378 (28.1%)
Wilms tumor	197 (14.6%)
Hodgkin's lymphoma	161 (12.0%)
Rhabdomyosarcoma	117 (8.7%)
Retinoblastoma	90 (6.7%)
Neuroblastoma	76 (5.7%)
Non-Hodgkin's lymphoma	70 (5.2%)
Acute myeloid leukemia	48 (3.5%)
Osteosarcoma	47 (3.5%)
Ewing sarcoma	31 (2.3%)
Nasopharyngeal cancer	27 (2.0%)
Other cancers**	104 (7.7%)
Total	1,345 (100%)
* There may be under representation of certain cancer types that require advanced diagnosis and treatment modalities such as radiotherapy, as it is not readily available in TASH.	

**Angiosarcoma, germ cell tumor, sacrococcygeal teratoma, yolk sack tumor, Burkitt lymphoma, hemangioma, soft tissue sarcoma, Kaposi sarcoma, neuroblastoma, chronic myeloid leukemia, thymoma

Supplementary text S1

Scoping review of childhood cancer survival rates in low-income countries in Africa

We conducted a scoping literature review to identify studies documenting the effectiveness of childhood cancer treatment in low-income countries (LICs) in Africa. The literature search was done in six electronic databases, including PubMed, Embase, ScienceDirect, Scopus, Web of Science, and African Journals OnLine by combining terms covering the spectrum of childhood cancer types, country names (LICs in Africa), and treatment outcomes (survival or mortality). The searches were not restricted by publication type, but priority was given to randomized control trials, systematic reviews, and meta-analysis papers summarizing important findings related to the purpose of this study. References reported in English, published in 2000–2019, and focusing on the treatment of childhood cancer (age 0–19 years) were included.

Following a review of titles, abstracts, and full texts, 14 studies were identified that met the eligibility criteria. Table S2 summarizes the basic characteristics of the reviewed papers. Overall, the studies varied greatly in scope, including in the number of centers and cancers covered, in sample sizes, and in duration of follow-up. Similarly, the estimated survival years reported in the studies were heterogeneous, with some estimating the 5-year event-free survival (EFS) rate while others used a 4-, 3-, 2-, or 1-year EFS rate. The estimated EFS rate for a given cancer also differed among pediatric oncology centers, which may be explained mainly by differences in access to care, quality of service, and available social support. We prioritized evidence from systematic reviews or meta-analyses, followed by that from prospective studies based on cancer registries, multicountry/multicenter studies, and those with large sample sizes, broad cancer coverage, long survival periods, and recently conducted studies. Generally, most of the mean EFS rate estimates (for two years and beyond) fell in the range of 35%–45%, some in 25%–35%, and very few above 50% (Table S2).

To assess the comparability of pediatric oncology centers, we reviewed available evidence on the basic characteristics of the pediatric oncology units in which the survival estimates were conducted. It was not possible to obtain adequate, detailed published data for most of the centers, however, so it was difficult to reach a conclusion on their comparability with high certainty given the limited availability of detailed information on medical infrastructure, human resource (number, mix, skill), consistent availability of diagnostics, therapeutic and clinical supportive care,

and the comprehensiveness of social support. However, we found little difference among the centers when assessing them using gross level parameters (Table S3).

Generally, it was difficult to adopt a single EFS rate value in our model; this was because the EFS rate estimates were disease specific (rather than overall EFS rates for all childhood cancers in a given oncology unit), because of differences in the pattern of cancers admitted to the centers, because of methodological difference in the EFS estimates, and because of the difficulty of ascertaining the comparability between TASH and the other centers. We used the scoping review to guide our EFS rate assumption in TASH rather than transferring a specific value from the studies. Even though most of the authors of the present study believed that the overall EFS rate at TASH ranged from 30% to 40%, we adopted 25% in our model to be on the safe side in avoiding biased cost-effectiveness conclusions. The 25% EFS rate assumption in our model was further triangulated with a treatment-abandonment rate study based on experts' judgments in three of the four pediatric oncology units in Ethiopia, in which the centers' nurses and pediatric oncologists were asked to describe the magnitude of and risk factors influencing treatment abandonment in their center (1). They were also asked about the overall survival rate of children with cancer in their center as follows: "At your center, what proportion of children diagnosed with cancer die within the first five years from diagnosis?" The perceived mean treatment abandonment rate in Ethiopia was high at 34%, with a 95% CI of 29.7%–39.7%. The mean perceived five-year EFS rate as judged by nurses and pediatric oncologists (N=27) was 37.5% (95% CI: 31.5%–44.0%), and the estimate by pediatric oncologists (N=3) was 25% (95% CI: 10%–40%). These findings were accounted for adopting a modest survival assumption in TASH.

We tested the robustness of our modeling by taking a low (15%) and high (35%) EFS rate. We used the 15% EFS rate to account for low estimates by some studies, such as a modeling-based survival rate prediction in LICs by Ward et al. and Atun et al. (2, 3), who used the global cancer registry to estimate the overall survival rate for Eastern African countries at 8.4% (95% CI: 4.4%–14.0%). However, this estimate was at the national level rather than at a specialized oncology center, so it will obviously be lower than the rate in a specialized center, which is the main interest of our study. Hence, we used the EFS rate of 15% as a lower bound in our sensitivity analysis, as almost all the scoping review findings from pediatric oncology centers are above 20%.

Table S2. Characteristics of the studies included in the literature review.

Cancer type	**Author**	**Country**	**Title**	**Study type**	**Follow-up duration/ estimated**	**Number of patients**	**Findings**

					survival period		
Acute lymphoblastic leukemia (ALL)	Rubagumya et al. (2017) (4)	Rwanda	Outcomes of Low-Intensity Treatment of Acute Lymphoblastic Leukemia at Butaro Cancer Center of Excellence in Rwanda	A retrospective study of ALL patients enrolled in care, July 1, 2012–June 30, 2014	2 years	42	The 2-year event-free survival (EFS) rate was 26% (95% CI: 13%–41%).
ALL	Kersten et al. (2013) (5)	Tanzania	Current Treatment and Outcome for Childhood Acute Leukemia in Tanzania	Retrospective study of patients enrolled January 1, 2008–December 31, 2010 at Ocean Road Cancer Institute; based on chart review	3 years	81	The 2-year EFS rate was 33% (95% CI: 15.9%–37.5%).
ALL	Joko-Fru et al. (2018) (6)	Kenya, Uganda, Zimbabwe	Survival from Childhood Cancers in Eastern Africa: A Population-Based Registry Study	Prospective study of children diagnosed with cancers in 1998–2009 who were	5 years	527 total patients, 52 with ALL	The mean 5-year survival rate for ALL was 57.8% (95% CI: 32.8%–77.6%) in Nairobi.

				followed for 5 years from date of diagnosis using a population-based cancer registry in Harari, Kampala, and Nairobi			The 3-year survival in Harare was 29% (95% CI: 10.5%–51.0%).
ALL	Liu et al. (2020) (7)	Uganda	Survival from Childhood Cancer in Kampala, Uganda	A prospective survival study of children diagnosed with cancer in 2010–2014 to estimate survival at 1 and 3 years after diagnosis using the Kampala Cancer Registry	3 years	221 total patients, 19 with ALL	The 3-year EFS rate was 46% (95% CI: 23%–67%).
Non-Hodgkin's lymphoma (NHL), excluding Burkitt's lymphoma	Joko-Fru et al. (2018) (6)	Kenya, Uganda, Zimbabwe	Survival from Childhood Cancers in Eastern Africa: A Population-Based Registry Study	Prospective study of children diagnosed with cancers in 1998–2009 who were followed for 5	5 years	527 total patients, 49 with NHL	The mean 5-year survival rate for NHL in Harare was 31% (95% CI: 17%–46%).

				years from date of diagnosis using a population-based cancer registry in Harari, Kampala, and Nairobi			
NHL, excluding Burkitt's lymphoma	Liu et al. (2020) (7)	Uganda	Survival from Childhood Cancer in Kampala, Uganda	A prospective survival study of children diagnosed with cancer in 2010–2014 to estimate survival at 1 and 3 years after diagnosis using the Kampala Cancer Registry	3 years	221 total patients, 18 with NHL	The 3-year EFS rate was 42% (95% CI: 17%–65%).
NHL, excluding Burkitt's lymphoma	Mutyaba et al. (2019) (8)	Uganda	Presentation and Outcomes of Childhood Cancer Patients at Uganda Cancer Institute	A retrospective survival study of children diagnosed with cancer in 2006–2009	1 year	310 total patients, 32 with NHL	The 1-year EFS rate was 43% (95% CI: 23%–61%).

Hodgkin's lymphoma (HL)	Mutyaba et al. (2019) (8)	Uganda	Presentation and Outcomes of Childhood Cancer Patients at Uganda Cancer Institute	A retrospective survival study of children diagnosed with cancer in 2006–2009	1 year	310 total patients, 20 with HL	The 1-year EFS rate was 68%.
HL	Ekenze et al. (2020) (9)		Wilms Tumor in Africa: A Systematic Review of Management Challenges and Outcome in Two Decades (2000–2019)	A systematic review of the outcome of Wilms tumor in Africa in 2000–2019; 27 studies involving 2,250 patients were analyzed.			The overall survival rate in Africa was 56.5%. The 2010–2019 overall survival rate in East Africa was 46.1% (95% CI: 25.0%–63.2%).
Wilms tumor	Paintsil et al. (2014) (10)	Malawi, Uganda	The Collaborative Wilms Tumor Africa Project: Baseline Evaluation of Wilms Tumor Treatment and Outcome in Eight Institutes in Sub-Saharan Africa	A retrospective study using a chart review of children diagnosed with Wilms tumor in 2011–2013	End of treatment (not clearly specified)	244 total Wilms tumor patients, 57 from Malawi and 54 from Uganda	The mean survival at end of treatment for the six centers in sub-Saharan Africa was 39%; it was 61% in Malawi and 11% in Uganda. Long-term survival (adjusted for relapse) in the six centers was 25%.

Wilms tumor	Joko-Fru et al. (2018) (6)	Kenya, Uganda, Zimbabwe	Survival from Childhood Cancers in Eastern Africa: A Population-Based Registry Study	Prospective study of children diagnosed with cancers in 1998–2009 who were followed for 5 years from date of diagnosis using a population-based cancer registry in Harari, Kampala, and Nairobi	5 years	527 total patients, 108 with Wilms tumor	The mean 5-year survival rate for Wilms tumor was 36% (95% CI: 22%–51%) in Harare and 8.6% (95% CI: 0.6%–32%) in Kampala.
Wilms tumor	Axt et al. (2013) (11)	Kenya	Wilms Tumor Survival in Kenya	A retrospective study using a chart review of patients diagnosed with Wilms tumor from January 1, 2008–2012	2 years	133	The 2-year EFS rate was 52.7%
Wilms tumor	Lui et al. (2020) (7)	Uganda	Survival from Childhood Cancer in Kampala, Uganda	A prospective survival study of children diagnosed with cancer in	3 years	221 total patients, 35 with Wilms tumor	The 3-year EFS rate was 30% (95% CI: 15%–47%).

				2010–2014 to estimate survival at 1 and 3 years after diagnosis using the Kampala Cancer Registry			
Wilms tumor	Mutyaba et al. (2019) (8)	Uganda	Presentation and Outcomes of Childhood Cancer Patients at Uganda Cancer Institute	A retrospective survival study of children diagnosed with cancer in 2006–2009	1 year	310 total patients, 28 with Wilms tumor	The 1-year EFS rate was 44% (95% CI: 22.5%–63.0%).
Retinoblastoma	Joko-Fru et al. (2018) (6)	Kenya, Uganda, Zimbabwe	Survival from Childhood Cancers in Eastern Africa: A Population-Based Registry Study	Prospective study of children diagnosed with cancers in 1998–2009 who were followed for 5 years from date of diagnosis using a population-based cancer registry in Harari,	5 years	527 total patients, 88 with retinoblastoma	The mean 5-year survival rate for retinoblastoma in Harare was 23% (95% CI: 9.7%–40.5%), and it was 65% in Nairobi.

				Kampala, and Nairobi			
Retinoblastoma	Lui et al. (2020) (7)	Uganda	Survival from Childhood Cancer in Kampala, Uganda	A prospective survival study of children diagnosed with cancer in 2010–2014 to estimate survival at 1 and 3 years after diagnosis using the Kampala Cancer Registry	3 years	221 total patients, 21 with retinoblastoma	The 3-year EFS rate was 57% (95% CI: 31%–76%).
Retinoblastoma	Waddell et al. (2014) (12)	Uganda	Improving Survival of Retinoblastoma in Uganda	Eighty-nine patients were prospectively followed in 2009–2013 after treatment with surgery and neoadjuvant chemotherapy at Ruharo Eye Hospital in Uganda			The 2-year EFS rate was 65%.
Retinoblastoma	Waddell et al. (2015) (13)	Uganda	Clinical Features and Survival	A national prospective cohort study of	3 years	282	The 3-year EFS rate was 45%

			among Children with Retinoblastoma in Uganda	children diagnosed with retinoblastoma in 2006–2011, before the introduction of neoadjuvant chemotherapy in Uganda			(95% CI: 37%–53%).
Retinoblastoma	Sankara et al. (2020) (14)	Burkina Faso	Epidemio-clinical Features of Retinoblastoma at the Yalgado Ouedraogo University Hospital Center in Burkina Faso: About 32 Cases	A retrospective study of patients diagnosed with retinoblastoma at Yalgado Ouedraogo University Hospital Center, January 2013–2017	5 years	32	The 5-year EFS rate was 34.37%.
Retinoblastoma	Traoré et al. (2018) (15)	Mali	Treatment of Retinoblastoma in Sub-Saharan Africa: Experience of the Pediatric Oncology Unit at Gabriel Toure Teaching Hospital and	A prospective study of children diagnosed with retinoblastoma in November 1, 2011–December 31, 2015	4 years and 2 months	88	The 4-year EFS rate was 59% (95% CI: 47.9%–69.5%).

			the Institute of African Tropical Ophthalmology, Bamako, Mali				
Burkitt's lymphoma	McGoldrick et al. (2019) (16)	Uganda	Survival of Children with Endemic Burkitt's Lymphoma in a Prospective Clinical Care Project in Uganda	A prospective study of children diagnosed with Burkitt's lymphoma in 2012–2017	4 years	181	The 4-year survival rate was 44% (95% CI: 36%–53%).
Burkitt's lymphoma	Joko-Fru et al. (2018) (6)	Kenya, Uganda, Zimbabwe	Survival from Childhood Cancers in Eastern Africa: A Population-Based Registry Study	Prospective study of children diagnosed with cancers in 1998–2009 who were followed for 5 years from date of diagnosis using a population-based cancer registry in Harari, Kampala, and Nairobi	5 years	527 total patients, 53 with Burkitt's lymphoma	The mean 5-year survival rate for Burkitt's lymphoma in Kampala was 45% (95% CI: 27.5%–61.5%).

Burkitt's lymphoma	Lui et al. (2020) (7)	Uganda	Survival from Childhood Cancer in Kampala, Uganda	A prospective survival study of children diagnosed with cancer in 2010–2014 to estimate survival at 1 and 3 years after diagnosis using the Kampala Cancer Registry	3 years	221 total patients, 35 with Burkitt's lymphoma	The 3-year EFS rate was 54% (95% CI: 33%–71%).
Burkitt's lymphoma	Mutyaba et al. (2019) (8)	Uganda	Presentation and Outcomes of Childhood Cancer Patients at Uganda Cancer Institute	A retrospective survival study of children diagnosed with cancer in 2006–2009	1 year	310 total patients, 87 with Burkitt's lymphoma	The 1-year EFS rate was 55% (95% CI: 42%–67%).
Miscellaneous	Lui et al. (2020) (7)	Uganda	Survival from Childhood Cancer in Kampala, Uganda	A prospective survival study of children diagnosed with cancer in 2010–2014 to estimate survival at 1 and 3 years after diagnosis	3 years	221 total patients, 42 with Kaposi sarcoma, 19 with rhabdomyosarcoma, and 14 with osteosarcoma	The 3-year EFS rate was 34% (95% CI: 20%–49%) for Kaposi sarcoma, 49% (95% CI: 12%–79%) for osteosarcoma, and 54% for

				using the Kampala Cancer Registry			rhabdomyosarcoma.
	Mutyaba et al. (2019) (8)	Uganda	Presentation and Outcomes of Childhood Cancer Patients at Uganda Cancer Institute	A retrospective survival study of children diagnosed with cancer in 2006–2009	1 year	310 total patients, 68 with Kaposi sarcoma	The 1-year EFS rate was 67% (95% CI: 52%–78%).
Overall LIC survival estimate (2, 3)*	Ward et al. (2019) (2); Atun et al. (2020) (3)	Global	Global Childhood Cancer Survival Estimates and Priority-Setting: A Simulation-Based Analysis	Micro-simulation of the 5-year survival rate for close to 200 countries	5 years		The 5-year survival rate for Eastern African countries was 8% (95% CI: 4.4%–14.0%).
* The estimate by Ward et al. (2019), Atun et al. (2020) were an average survival rate for all childhood cancers and at a national level while the other study reports were cancer specific and at a specialized pediatric oncology unit level. This may explain the large survival rate estimate difference among the reports.							

Table S3. Basic characteristics of the pediatric oncology centers included in the scoping review

Parameters	TASH[a] (1, 10)	QECH[b] (10, 17)	ORCI[c] (5)	UCI[d] (10)	BCER[e] (4, 18)

LIC	Yes	Yes	Yes	Yes	Yes
Dedicated pediatric oncology center	Yes since 2013	Yes since 1997	Yes since 1996	Yes since 2011	Yes since 2011
Patient volume	500–600 (in 2013)	200 (in 2013)	230 (in 2010)	450 (in 2013)	169 (in 2014)
Inpatient beds	40 (in 2013)	24	17 (2010)	23 (in 2013)	
Nurse: patient ratio	1:4 in daytime and 1:10 at night	1:15 in daytime and 1:30 at night	1:15 in daytime and 1:30 at night	1:20 in daytime and 1:40 at night	1:15 in daytime and 1:30 at night
Pediatric oncologist	Trained pediatric oncologists available	Experienced pediatrician	Trained pediatric oncologists available	Trained pediatric oncologists available	Experienced pediatrician

Diagnostics	Chemistry, X-ray, computerized tomography (CT) , pathology, and ultrasound services were available at subsidized cost but mostly inconsistent. Magnetic resonance imaging (MRI) was not available at the time of the study (2019).	X-ray, ultrasound CT, MRI, and pathology were available for free.	X-ray, CT, MRI, pathology, and chemistry were mostly consistently available for free.	X-ray, CT, pathology, and chemistry were available but not MRI.	X-ray, ultrasound, and pathology services were available. Imaging services, such as CT and MRI were provided through referral to another hospital (in 2014).
Therapeutics	Chemotherapy was available at a subsidized cost but inconsistent. Radiotherapy was available but with a long waiting time.	Chemotherapy was available for free.	Most chemotherapy was consistently available for free; radiotherapy was also available.	Chemotherapy was available. Radiotherapy was available in another referral hospital (Mulago National Referral Hospital).	Chemotherapy was available. Radiotherapy was not available in 2014.

Clinical supportive care (ER, ICU, blood service, surgery)	Pediatric ER, ICU, surgery, and blood service were available within the hospital.		ICU was not available.	Surgery was available in another referral hospital (Mulago National Referral Hospital).	ICU and surgery service were provided through referral.
Twinning partnership	Yes	Yes	Yes	Yes	
Social supports	Yes	Yes	Yes	Yes	Yes

[a]TASH: Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia
[b]QECH: Queen Elizabeth Central Hospital, Blantyre, Malawi
[c]ORCI: Ocean Road Cancer Institute, Dar es Salaam, Tanzania
[d]UCI: Uganda Cancer Institute, Kampala, Uganda
[e]BCER: Butaro Center of Excellence in Rwanda

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