Cancer survival in sub-Saharan Africa (SURVCAN-3): a population-based study

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Summary

Background The Cancer Survival in Africa, Asia, and South America project (SURVCAN-3) of the International Agency for Research on Cancer aims to fill gaps in the availability of population-level cancer survival estimates from countries in these regions. Here, we analysed survival for 18 cancers using data from member registries of the African Cancer Registry Network across 11 countries in sub-Saharan Africa.

Methods We included data on patients diagnosed with 18 cancer types between Jan 1, 2005, and Dec 31, 2014, from 13 population-based cancer registries in Cotonou (Benin), Abidjan (Côte d'Ivoire), Addis Ababa (Ethiopia), Eldoret and Nairobi (Kenya), Bamako (Mali), Mauritius, Namibia, Seychelles, Eastern Cape (South Africa), Kampala (Uganda), and Bulawayo and Harare (Zimbabwe). Patients were followed up until Dec 31, 2018. Patient-level data including cancer topography and morphology, age and date at diagnosis, vital status, and date of death (if applicable) were collected. The follow-up (survival) time was measured from the date of incidence until the date of last contact, the date of death, or until the end of the study, whichever occurred first. We estimated the 1-year, 3-year, and 5-year survival (observed, net, and age-standardised net survival) by sex, cancer type, registry, country, and human development index (HDI). 1-year and 3-year survival data were available for all registries and all cancer sites, whereas availability of 5-year survival data was slightly more variable; thus to provide medium-term survival prospects, we have focused on 3-year survival in the Results section.

Findings 10 500 individuals from 13 population-based cancer registries in 11 countries were included in the survival analyses. 9177 (87·4%) of 10 500 cases were morphologically verified. Survival from cancers with a high burden and amenable to prevention was poor: the 3-year age-standardised net survival was 52·3% (95% CI 49·4–55·0) for cervical cancer, 18·1% (11·5–25·9) for liver cancer, and 32·4% (27·5–37·3) for lung cancer. Less than half of the included patients were alive 3 years after a cancer diagnosis for eight cancer types (oral cavity, oesophagus, stomach, larynx, lung, liver, non-Hodgkin lymphoma, and leukaemia). There were differences in survival for some cancers by sex: survival was longer for females with stomach or lung cancer than males with stomach or lung cancer, and longer for males with non-Hodgkin lymphomas than females with non-Hodgkin lymphomas. Survival did not differ by country-level HDI for cancers of the oral cavity, oesophagus, liver, thyroid, and for Hodgkin lymphoma.

Interpretation For cancers for which population-level prevention strategies exist, and with relatively poor prognosis, these estimates highlight the urgent need to upscale population-level prevention activities in sub-Saharan Africa. These data are vital for providing the knowledge base for advocacy to improve access to prevention, diagnosis, and care for patients with cancers in sub-Saharan Africa.

Funding Vital Strategies, the Martin-Luther-University Halle-Wittenberg, and the International Agency for Research on Cancer.

Introduction

In 2020, there were an estimated 801 392 new cancers diagnosed and half a million cancer deaths in sub-Saharan Africa.[1] Although this figure corresponds to fewer incident cancer cases in sub-Saharan Africa than other regions, poorer survival outcomes have been consistently reported. This is largely linked to few early detection programmes and poor access to quality care. International cancer survival benchmarking studies have been done to compare survival outcomes across

Lancet Glob Health 2024; 12: e947–59

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For the French translation of the abstract see **Online** for appendix 1

For the Portuguese translation of the abstract see **Online** for appendix 2

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Research in context

Evidence before this study

Survival after cancer diagnosis has improved in many countries worldwide in the past three decades, however, cancer survival continues to vary largely across populations, with lower survival reported in countries in the sub-Saharan African region than in other regions. We searched PubMed from database inception to Oct 1, 2023, using the search terms "cancer", "survival", "sub-Saharan Africa", and "cancer registry" for population-based studies without time or language restrictions. Our scoping review identified systematic reviews on survival outcomes of patients in sub-Saharan Africa with cancers of the breast, cervix, stomach, and colorectum. Most studies on cancer survival in sub-Saharan Africa reported on hospital-based follow-up of cancer patients, which are not representative of the general population. The SURVCAN and CONCORD series, which included patients with cancer in sub-Saharan Africa, focus on global comparisons of cancer survival at the population level. These studies showed substantial differences in survival for major cancer sites between countries in sub-Saharan Africa; survival was lowest in countries within the lowest human development index (HDI) category. For example, the 3-year net survival of patients diagnosed with breast cancer in Uganda (low HDI) was 27·1% compared with 87·7% in Namibia (high HDI). Cancer patterns in sub-Saharan Africa differ substantially to other world regions, yet no systematic comparisons of survival outcomes have been done using up-to-date follow-up data focusing on sub-Saharan Africa for cancers that are commonly diagnosed in the region. Such comparisons are particularly important for assessing the impact of cancer care policies in sub-Saharan Africa at the population level.

Added value of this study

In this study, we collate population-level survival data for 18 cancer types from more sub-Saharan African countries, using more up-to-date follow-up data and a wider period of diagnosis than previous analyses, and for additional cancer types with especially high incidence burden in the region, namely Kaposi sarcoma and Hodgkin lymphoma, and rare cancer types that have never been reported on such as corpus uteri, thyroid, and laryngeal cancer. This study presents unique datasets beyond the work previously presented in the SURVCAN-3 study and serves as an opportunity to highlight and focus on the challenges of cancer survival in this region. Furthermore, we used both the International Cancer Survival Standards and the World Cancer Patient Populations to facilitate comparisons with earlier studies. Additionally, survival results are presented at 1, 3, and 5 years after diagnosis to show outcomes at different stages of the treatment pathways. We identified large disparities in cancer survival within sub-Saharan Africa. Our findings also highlight the poor survival outcomes of cancers amenable to prevention in this continent.

Implications of all the available evidence

The study has increased the availability and breadth of data on cancer survival outcomes in sub-Saharan Africa, and the findings serve as a crucial reminder of the importance of scaling up population-level cancer prevention activities in sub-Saharan Africa, and the necessity of increasing access to optimal cancer care.

populations.[2,3] These studies are important for highlighting regional differences, and for influencing health policy, considering that population-level cancer survival is a measure of the overall efficacy of the cancer care system.[2] Due to the paucity of data from sub-Saharan Africa, there have been relatively few international benchmarking studies that include results from the sub-continent. To address this gap, the International Agency for Research on Cancer (IARC) launched the Cancer survival in Africa, central and south America, and Asia studies (SURVCAN).[4] SURVCAN-2, published in 2011, included cases diagnosed between 1993 and 1997 from three sub-Saharan Africa population-based cancer registries in The Gambia, Kampala (Uganda), and Harare (Zimbabwe).[4] Since SURVCAN-2 was published, there have been improvements in early detection and cancer treatment for some cancers in many parts of the world, however, little information is available as to how these advances in early detection and screening have translated to population-level cancer survival benefits for countries in sub-Saharan Africa. In 2023, SURVCAN-3 was published,[5] and reported cancer survival outcomes for patients from Africa, central and south America, and Asia diagnosed between 2008 and 2012, who were followed up until 2014. As part of the SURVCAN-3 project, here, we present an in-depth analysis of cancer survival in sub-Saharan Africa from member registries of the African Cancer Registry Network (AFCRN), which includes more cancer types than the SURVCAN-3 study, with a longer follow-up. This permits a more thorough discussion on the availability and completeness of population-level cancer survival data, and reasons for the disparities in cancer survival outcomes observed across sub-Saharan Africa.

Methods

Data collection

We obtained data for adult patients (aged ≥15 years) diagnosed with 18 cancer types between Jan 1, 2005, and Dec 31, 2014, who were included in member registries of the AFCRN from Cotonou (Benin), Abidjan (Côte d'Ivoire), Addis Ababa (Ethiopia), Eldoret and Nairobi (Kenya), Bamako (Mali), Mauritius, Namibia, Seychelles, Eastern Cape (South Africa), Kampala (Uganda), and Bulawayo and Harare (Zimbabwe).

A random sample of incident cases diagnosed between Jan 1, 2005, and Dec 31, 2014, was selected from eight registries, and the exact sample size was determined by the practical feasibility of obtaining follow-up information and was a function of the total incident cases in the period concerned. In five registries, cases were selected without random sampling: in Cotonou (Benin), all cases diagnosed between July 1, 2013, and Dec 31, 2014 were included; in Addis Ababa (Ethiopia), all cases with 50 cases or more per site diagnosed in 2012 were included; in Mauritius, all cases were included for all sites (with the exception of breast and colorectal cancers, which were randomly sampled); in Seychelles, all cases with 40 cases or more per site diagnosed between Jan 1, 2008, and De 31, 2013, were included; and in the Eastern Cape Cancer Registry (ECCR; South Africa), all cases diagnosed between Jan 1, 2008, and Dec 31, 2012, were included. The follow-up (survival) time was measured from the date of incidence until the date of last contact, the date of death, or until the end of the study, which ever occurred first. The end date was Dec 31, 2016 in Bulawayo, Dec 31, 2017 for Cotonou, Abidjan, Addis-Ababa, Eldoret, Nairobi, Bamako, Mauritius, Seychelles, and Harare and Dec 31, 2018 for Namibia, the ECCR, and Kampala. All included registries are members of AFCRN and therefore met the criterion of collecting a minimum of 70% of incident cancers in their respective populations. The data collected by the registries are standardised, and the IARC software system CanReg-5 is used by all registries for data entry and management. SURVCAN-3 was approved by the IARC Ethics Committee on Sept 15, 2016 (number 16–37). The International Classification of Diseases, tenth revision (ICD-10) was used to categorise cancers. Here, for brevity we refer to liver and intrahepatic bile ducts cancer (ICD-10 C22) as liver cancer and tracheal, bronchial, and lung cancer (C33–34) as lung cancer. This study was approved by the scientific committees of the AFCRN and ethics committees of the relevant agencies of the individual member registries contributing data for the study.

Vital status was obtained by passive follow-up for Mauritius and by active follow-up for all other registries. As part of the study, active follow-up was performed by tracing and examination of clinical records of cases not known to have died and the patient's vital status at the closing date was recorded. Cases whose vital status could not be confirmed by this procedure were called when a telephone number was registered in the registry record. When no further information could be obtained, the registry staff made home visits. In Mauritius, passive follow-up was done to ascertain the vital status of patients; this involves linkage of the list of registered cases with the population death records held in the vital statistics office. Survival times of patients whose vital status (alive or dead) could not be ascertained by the closing date of the study were censored as alive at the date of the last contact.

Statistical analysis

The mean age at diagnosis and the proportion of cases with morphological verification of diagnosis were calculated for each cancer type. Cases registered on the basis of a death certificate only, with no follow-up information or with incoherent follow-up dates were excluded from the survival analyses. Cancer types with survival data from fewer than 30 cases for all registries combined were also excluded from the survival analyses to avoid biased estimates caused by small numbers.

Survival was estimated using the semi-complete approach, which uses the survival probabilities of patients with complete follow-up (diagnosed 5 years before the closing date) and the survival probabilities of patients diagnosed more recently (with <5 years of follow-up) but with a potential minimum follow-up time of 1 year.[6] Observed all-cause survival was calculated by the Kaplan–Meier method by cancer type, sex, registry, and country. We then calculated the Pohar–Perme estimate of net survival at 1, 3, and 5 years after diagnosis using the strs command in Stata with the pohar specification to estimate the Pohar–Perme net survival. The net survival is the survival probability from the cancer of interest in the absence of competing causes of death.[7] Age-standardised net survival was calculated using the strs command in Stata, based on standard weights from the World Cancer Patient Population[8] and the International Cancer Survival Standards.[9] 1-year and 3-year survival data were available for all registries and all cancer sites, whereas availability of 5-year survival data was slightly more variable. To provide medium-term survival prospects, we have focused on 3-year survival in the Results section.

Abridged life tables by sex, age group, and country were obtained from the WHO Global Health Observatory data repository. The number of deaths and person-time by sex, year, and country were used to estimate mortality rates using a Poisson regression with a flexible function to expand the abridged age groups (0–4, 5–9, 10–14... ≥80 years) to single ages (0, 1, 2, 3,....99 years) based on methods first described by Rachet and colleagues.[10]

We also categorised survival estimates by Human Development Index (HDI), which is a composite measure developed by the UN Development Programme including life expectancy at birth, the educational attainment of citizens, and the gross national income per capita.[11] A development index of less than 0·55 is categorised as low HDI, 0·55–0·69 as medium HDI, 0·70–0·79 as high HDI, and 0·80 or higher as very high HDI.

For **WHO Global Health Observatory data repository life tables** see https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-ghe-life-tables-by-country

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

	Country-level HDI, 2015	Registry coverage	Registry type	Period of diagnosis	End of follow-up	Cases selected for analysis, n	Proportion of morphologically verified cases, %	Excluded cases, n					Total excluded, n (%)	Number included for survival analyses (%)
								Cases diagnosed on the basis of a death certificate only, n	Age unknown or out of range*, n	Other†	No follow-up data	Small numbers per site		
Cotonou (Benin)	Low	Sub-national	Urban	2013–14	2017	172	73·8%	0	0	3	0	0	3 (1·7%)	169 (98·3%)
Abidjan (Côte d'Ivoire)	Low	Sub-national	Rural	2012	2017	571	66·9%	0	2	153	6	4	165 (28·9%)	406 (71·1%)
Addis Ababa (Ethiopia)	Low	Sub-national	Urban	2012	2017	1539	87·3%	2	30	9	116	25	182 (11·8%)	1357 (88·2%)
Eldoret (Kenya)	Medium	Sub-national	Urban and rural	2009–13	2017	1040	94·7%	0	30	4	437	75	546 (52·5%)	494 (47·5%)
Nairobi (Kenya)	Medium	Sub-national	Urban	2009–11	2017	203	94·6%	0	24	73	0	0	97 (47·8%)	106 (52·2%)
Bamako (Mali)	Low	Sub-national	Urban	2012–13	2017	151	98·7%	0	0	11	55	0	66 (43·7%)	85 (56·3%)
Mauritius	High	National	Urban and rural	2005–09	2017	2853	97·4%	0	27	0	4	0	31 (1·1%)	2822 (98·9%)
Namibia	Medium	National	Urban and rural	2012–13	2018	409	95·8%	0	5	7	112	0	124 (30·3%)	285 (69·7%)
Seychelles	High	National	Urban	2008–13	2017	449	92·9%	0	0	3	25	0	28 (6·2%)	421 (93·8%)
ECCR (South Africa)	Medium	Subnational	Urban	2008–12	2018	3341	85·9%	0	58	0	344	423	825 (24·7%)	2516 (75·3%)
Kampala (Uganda)	Low	Subnational	Urban	2009–13	2018	735	52·9%	0	1	4	192	0	197 (26·8%)	538 (73·2%)
Bulawayo (Zimbabwe)	Low	Subnational	Urban	2012–13	2016	289	78·6%	1	3	16	20	0	40 (13·8%)	249 (86·2%)
Harare (Zimbabwe)	Low	Subnational	Urban	2009–13	2017	1289	83·1%	0	14	74	149	0	237 (18·4%)	1052 (81·6%)
Overall	NA	NA	NA	2005–14	2018	13 041	85·7%	3	194	357	1460	527	2541 (19·5%)	10 500 (80·5%)

HDI=Human Development Index. ECCR=Eastern Cape Cancer Registry. NA=not applicable. *Children aged younger than 15 years were excluded (ie, age outside of range). †Cases were excluded because of missing vital status, duplicate cases, or incoherent dates.

Table 1: **Number of cases selected, excluded, and included for survival analyses by registry**

Results

In this study, 13 041 cases were selected from 13 population-based cancer registries in 11 countries. Of the 13 registries, seven were in a country categorised as being of low HDI. The registries of Mauritius, Seychelles, and Namibia cover the national territory. All the other registries cover urban areas, with the exception of the ECCR, which covers a rural area (table 1). Cases were diagnosed between Jan 1, 2005, and Dec 31, 2014. The number of cases included per registry ranged from 151 cases in Bamako (Mali) to 3341 cases in the ECCR (South Africa; table 1).

Of the 13 041 included cases, 10 500 cases (80·5%) were included in the survival analyses. Of all cases, we excluded; three cases (0·02%) diagnosed on the basis of a death certificate only, 194 cases (1·5%) with an unknown age or age outside of included age range (<15 years), 357 cases (2·7%) with missing information on vital status or with incoherent dates of diagnosis and date of last contact, 1460 cases (11·2%) with no follow-up information after diagnosis, and 527 cases (4·0%) of cases with fewer than 30 cancer cases for all registries combined.

Table 2 shows the number of included cancers for each type. The most common cancers were breast, cervix, colon-rectum, prostate, and oesophagus, comprising 70% of all included cases. The median age at diagnosis was younger than 50 years for patients with Hodgkin lymphoma (27 years [IQR 21–49]), Kaposi sarcoma (36 years [30–44]), leukaemia (44 years [30–61]), non-Hodgkin lymphoma (44 years [34–55]), and thyroid cancers (46 years [34–57]). There was a higher proportion of cancers of the oral cavity, larynx, lung, and bladder among males, while thyroid cancers were predominantly observed among females. Of all cancer types, 9173 (87·4%) of 10 500 cases were morphologically verified, but the proportion of morphologically verified cases varied by cancer type, with the lowest proportion of morphologically verified cases observed for cancers of the liver (131 cases [56·7%]).

Table 3 shows the number of cases included and the 1-year, 3-year, and 5-year survival by cancer type, by sex, and by HDI, where possible, for all registries combined. For all registries combined, the 1-year age-standardised net survival ranged from 28·0% (95% CI 22·2–34·1) for liver cancers to 93·4% (75·0–98·4) for Hodgkin lymphoma. The 3-year age-standardised net survival ranged from 18·1% (11·5–25·9) for liver cancer to 72·6% (60·4–81·6) for thyroid cancer (table 3). The observed survival was similar by sex for most cancer types, with the exception of stomach and lung cancers, for which survival was higher for females (log-rank test p<0·0001), and for Hodgkin disease (log-rank test p=0·0418) and non-Hodgkin lymphoma (log-rank test p=0·015) where survival was higher for males (table 3, figure 1). There were survival differences by HDI for most cancer types, with the exception of patients with cancers of the oesophagus, oral cavity, liver, and thyroid,

	Number included for survival analyses, n	Period of diagnosis	Median age at diagnosis, years (range)	Males, n (%)	Females, n (%)	Proportion of morphologically verified cases, %
Oral cavity (C01–06)	123	2008–13	60 (15–94)	99 (80·5%)	24 (19·5%)	96·8%
Oesophagus (C15)	884	2008–13	65 (21–97)	417 (47·2%)	467 (52·8%)	88·4%
Stomach (C16)	547	2005–13	63 (22–94)	322 (58·9%)	225 (41·1%)	91·0%
Colon and rectum (C18–20)	1289	2005–13	60 (16–98)	632 (49·0%)	657 (51·0%)	89·0%
Liver and intrahepatic bile ducts (C22)	230	2008–13	56 (16–93)	116 (50·4%)	114 (49·6%)	57·0%
Larynx (C32)	48	2008–12	65 (27–90)	43 (89·6%)	5 (10·4%)	93·8%
Trachea, bronchus, and lung (C33–34)	534	2005–13	65 (15–98)	367 (68·7%)	167 (31·3%)	87·6%
Kaposi sarcoma (C46)	134	2008–12	36 (16–78)	68 (50·8%)	66 (49·2%)	77·6%
Breast (C50)	2121	2005–14	51 (17–99)	0	2121 (100%)	90·2%
Cervix uteri (C53)	1954	2005–14	54 (19–98)	NA	1954 (100%)	87·4%
Corpus Uteri (C54)	48	2008–12	63 (28–83)	NA	48 (100%)	72·9%
Ovary (C48·1–2, C56, C57·0)	407	2005–13	50 (17–89)	NA	407 (100%)	89·7%
Prostate (C61)	1122	2005–14	72 (34–99)	1122 (100%)	NA	77·8%
Bladder (C67)	212	2005–13	65 (16–89)	189 (89·2%)	23 (10·8%)	92·9%
Thyroid (C73)	157	2005–12	46 (15–86)	24 (15·3%)	133 (84·7%)	96·2%
Hodgkin Disease (C81)	32	2008–13	27 (15–60)	16 (50·0%)	16 (50·0%)	100·0%
Non-Hodgkin lymphoma (C82–86, C96)	454	2006–13	44 (15–93)	256 (56·4%)	198 (43·6%)	89·4%
Leukaemia (C91–95)	204	2008–13	44 (15–92)	120 (58·8%)	84 (41·2%)	98·0%
Total	10 500	2005–14	58 (15–99)	3791 (36·1%)	6709 (63·9%)	87·4%

ICD-10=International Classification of Diseases, tenth revision. NA=not applicable.

Table 2: **Patient characteristics by cancer type (as per ICD-10 classification)**

where survival outcomes were not statistically different by country-level HDI (figure 2; appendix 3 pp 2–10).

More granular results of the 1-year, 3-year, and 5-year age-standardised net survival by cancer type and by registry are presented in appendix 3 (pp 2–10). These findings show the disparity in cancer survival by type across different registries in sub-Saharan Africa. For example, for cervical cancer, the 3-year age-standardised net survival ranged from 12·4% (95% CI 6·2–20·7) in Bamako (Mali) to 84·4% (78·9–88·5) in Mauritius. In figure 3, the 3-year age-standardised net survival was compared by cancer type and by registry for all cancer types with cases from more than one registry and who had patients surviving 3 years after diagnosis. There was large variability in cancer survival outcomes by country in sub-Saharan Africa. Variability in survival outcomes was observed across cancer types with a relatively good prognosis (eg, 3-year age-standardised net survival for breast cancer ranged from 31·3% in Kampala, Uganda, to 94·1% in Namibia) and for cancers with a poor prognosis (3-year age-standardised net survival for liver cancer ranged from 0·4% in Abidjan, Côte d'Ivoire, to 18·3% in Addis Ababa, Ethiopia).

In Harare (Zimbabwe), data were available by ethnicity, and we were able to estimate survival among White and Black individuals. Overall, 11% of all cancer cases recorded in the registry were among White individuals (European ancestry): 62 (26%) of 234 people with breast cancer were White and 49 (21%) of 239 people with colorectal cancer were White. Survival for these two cancers among Zimbabwean people was higher among White individuals than Black individuals: 5-year survival was 43·5% (95% CI 35·9–50·8) for Black individuals versus 64·5% (49·9–75·9) for White individuals with breast cancer, and 26·4% (19·8–33·5) for Black individuals versus 44·0% (29·6–57·5) for White individuals with colorectal cancer (appendix 3 p 11).

See Online for appendix 3

Discussion

In this study, which expands on the data collected in the SURVCAN-3 project,[5] we report survival rates for 18 cancer types focusing on patients from 13 population-based cancer registries in 11 sub-Saharan African countries diagnosed between 2005 and 2014. In sub-Saharan Africa, the age-standardised net survival 3 years after diagnosis was higher than 70% for cancers of the thyroid (72·6%), ovary (71·2%), and corpus uteri (70·9%). Age-standardised net survival 3 years after diagnosis ranged from 50% to 70% for six cancers: breast (68·7%), Hodgkin lymphoma (67·3%), colon and rectum (57·7%), bladder (56·9%), and cervix (52·3%). Less than half of the patients were alive 3 years after a cancer diagnosis for the remaining eight cancers (oral cavity, oesophagus, stomach, larynx, lung, liver, non-Hodgkin lymphoma, and leukaemia). For the most common cancers in Africa (breast, cervical, prostate, and colorectal cancers) survival outcomes were different by country-level HDI (a proxy for access to care), which

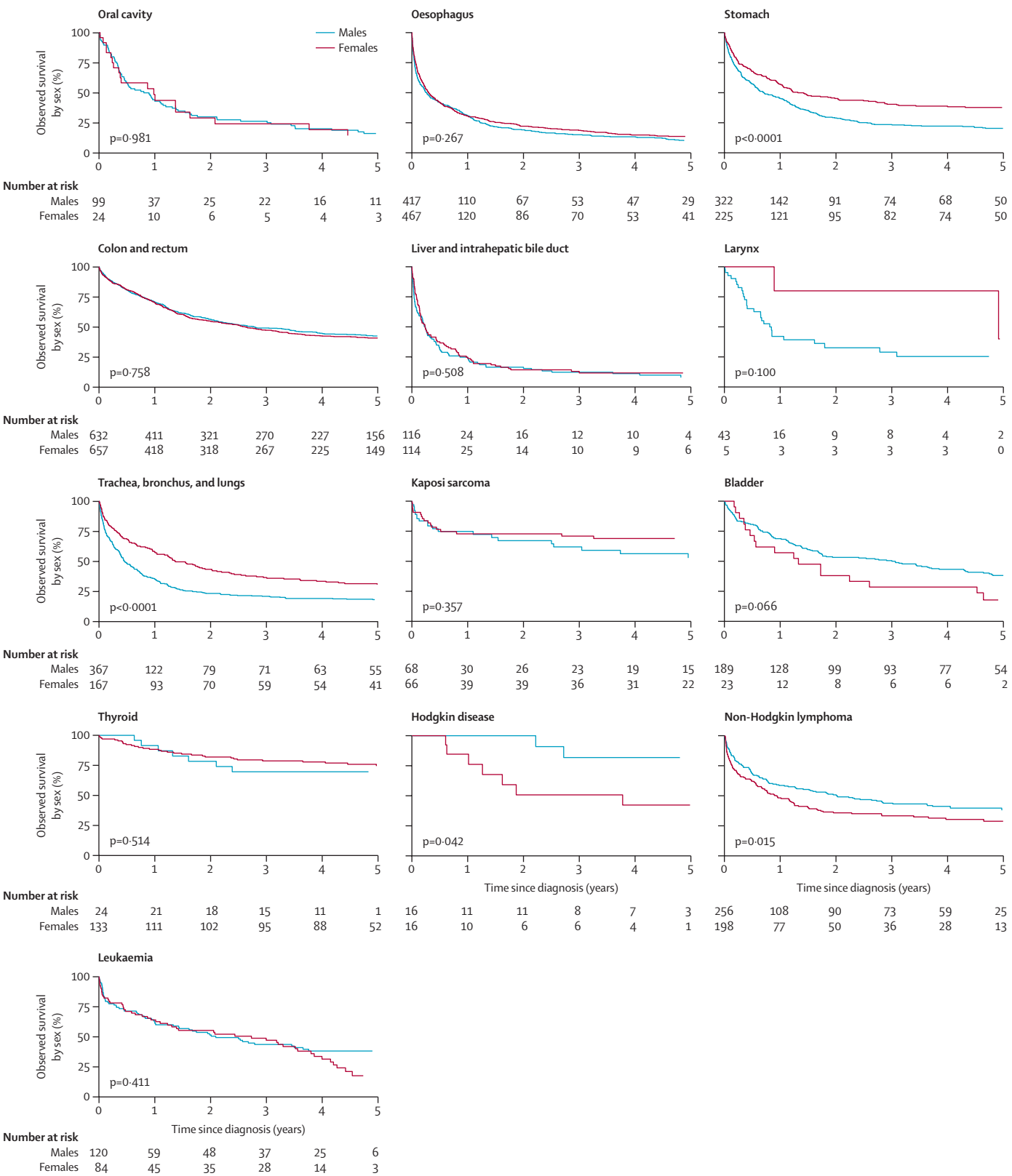
	Included cases, n	Observed survival, % (95% CI)			Age-standardised net survival, % (95% CI)		
		1 year	3 years	5 years	1 year	3 years	5 years
Oral cavity (C01–06)							
All cases	123	44·2% (34·9–53·1)	26·0% (18·2–34·5)	15·9% (9·6–23·6)	56·4% (46·8–64·8)	37·6% (24·7–50·4)	23·9% (11·8–38·4)
Male	99	43·1% (32·8–53·0)	26·5% (17·7–36·0)	16·3% (9·3–25·0)	59·4% (51·2–66·6)	41·4% (25·1–57·0)	18·8% (9·4–30·8)
Female	24	48·6% (27·4–66·9)	24·3% (9·0–43·5)	14·6% (3·7–32·5)	62·4% (42·1–77·3)	28·2% (11·6–47·5)	17·1% (4·7–36·1)
High HDI	83	45·0% (29·3–59·5)	27·5% (14·9–41·7)	19·1% (8·5–32·8)	59·9% (48·9–69·3)	49·6% (37·7–60·3)	NA*
Medium HDI	40	44·3% (32·7–55·2)	25·4% (15·8–36·2)	14·3% (7·1–23·9)	55·2% (43·6–65·4)	34·3% (19·6–49·5)	27·2% (11·7–45·3)
Oesophagus (C15)							
All cases	884	30·9% (27·7–34·2)	17·2% (14·6–19·9)	12·2% (9·9–14·7)	34·9% (32·0–37·9)	23·6% (20·2–27·1)	21·1% (17·0–25·6)
Male	417	31·0% (26·4–35·7)	15·3% (11·8–19·2)	10·2% (7·3–13·7)	34·7% (30·4–39·0)	21·5% (16·7–26·8)	18·5% (12·9–25·0)
Female	467	30·9% (26·5–35·4)	18·9% (15·2–22·9)	13·9% (10·6–17·5)	35·1% (31·1–39·1)	25·3% (20·8–30·0)	23·3% (17·6–29·5)
Medium HDI	753	32·0% (28·5–35·5)	18·6% (15·7–21·8)	12·9% (10·4–15·7)	36·7% (33·4–40·0)	26·0% (22·2–29·9)	22·3% (17·7–27·2)
Low HDI	131	25·9% (18·8–33·7)	9·6% (5·2–15·8)	8·4% (4·2–14·5)	24·9% (18·9–31·5)	11·6% (6·1–18·9)	15·3% (7·0–26·6)
Stomach (C16)							
All cases	547	50·3% (46·0–54·5)	30·5% (26·7–34·5)	27·5% (23·7–31·4)	53·2% (48·7–57·4)	37·5% (32·5–42·6)	42·2% (35·2–49·0)
Male	322	45·5% (39·9–50·9)	23·7% (19·2–28·5)	20·6% (16·2–25·2)	48·1% (42·4–53·6)	29·0% (23·0–35·3)	30·0% (22·2–38·2)
Female	225	57·2% (50·3–63·4)	40·5% (33·9–47·0)	37·9% (31·3–44·4)	59·7% (52·7–65·9)	48·9% (40·7–56·7)	58·1% (46·4–68·1)
High HDI	343	53·6% (48·2–58·8)	35·9% (30·8–40·9)	32·8% (27·8–37·8)	57·2% (51·5–62·5)	45·5% (38·6–52·1)	53·2% (43·1–62·3)
Medium HDI	106	44·1% (33·9–53·9)	14·0% (7·5–22·4)	8·4% (3·5–15·9)	46·9% (36·5–56·6)	16·7% (8·8–26·6)	7·7% (2·8–16·1)
Low HDI	98	45·0% (34·8–54·5)	26·0% (17·7–35·1)	26·0% (17·7–35·1)	45·7% (35·7–55·2)	27·3% (17·9–37·6)	31·7% (20·1–43·9)
Colon and rectum (C18–20)							
All cases	1289	70·5% (67·7–73·0)	48·2% (45·3–51·0)	41·7% (38·8–44·5)	74·3% (71·3–77·1)	57·7% (53·8–61·4)	59·3% (54·3–64·0)
Male	632	70·9% (67·0–74·3)	49·2% (45·0–53·2)	42·6% (38·4–46·6)	72·9% (68·3–76·9)	57·2% (51·5–62·5)	58·4% (50·8–65·1)
Female	657	70·2% (66·4–73·7)	47·3% (43·3–51·3)	40·9% (36·8–44·8)	74·9% (70·7–78·6)	57·6% (52·1–62·7)	59·5% (52·6–65·7)
High HDI	572	81·1% (77·7–84·1)	62·9% (58·8–66·8)	57·1% (52·9–61·0)	84·4% (80·5–87·6)	73·2% (67·8–77·8)	77·2% (70·2–82·8)
Medium HDI	163	62·9% (54·2–70·4)	39·4% (30·8–47·8)	32·7% (24·5–41·2)	64·4% (54·0–73·1)	38·2% (27·4–48·9)	37·2% (23·8–50·5)
Low HDI	554	60·5% (56·1–64·7)	32·8% (28·6–37·1)	24·2% (20·0–28·5)	63·6% (58·3–68·5)	41·4% (28·2–40·0)	39·0% (30·1–47·8)
Liver and intrahepatic bile ducts (C22)							
All cases	230	24·8% (19·2–30·9)	12·8% (8·6–17·9)	10·0% (6·2–15·0)	28·0% (22·2–34·1)	18·1% (11·5–25·9)	16·7% (9·1–26·4)
Male	116	25·0% (17·1–33·6)	12·5% (6·9–19·8)	8·1% (3·4–15·4)	28·5% (19·9–37·7)	19·6% (9·9–31·6)	15·3% (5·8–29·0)
Female	114	24·9% (17·0–33·5)	13·2% (7·4–20·7)	11·9% (6·3–19·3)	27·1% (19·5–35·2)	16·1% (8·6–25·6)	18·7% (9·1–31·0)
Medium HDI	110	33·2% (23·7–43·0)	20·9% (13·0–30·0)	15·6% (8·8–24·3)	35·4% (26·6–44·4)	27·4% (16·9–38·8)	24·3% (11·7–39·5)
Low HDI	120	19·2% (12·7–26·8)	6·9% (3·0–12·8)	NA*	20·3% (13·5–28·1)	7·4% (3·3–13·7)	NA*
Larynx (C32)†‡							
All cases	48	46·3% (31·3–60·1)	34·7% (20·5–49·3)	23·7% (9·1–42·0)	51·3% (35·8–64·8)	45·9% (28·1–62·1)	48·9% (26·4–68·1)
Trachea, bronchus, and lung (C33–34)							
All cases	534	42·6% (38·2–46·8)	26·0% (22·3–29·9)	22·3% (18·8–26·0)	46·0% (41·7–50·2)	32·4% (27·5–37·3)	33·5% (27·4–39·8)
Male	367	35·5% (30·5–40·5)	21·1% (17·0–25·5)	18·3% (14·4–22·6)	38·6% (33·9–43·3)	26·6% (21·5–32·0)	27·9% (21·6–34·5)
Female	167	57·8% (49·8–64·9)	36·7% (29·3–44·0)	30·8% (23·8–38·1)	64·3% (56·0–71·4)	46·0% (35·1–56·2)	47·8% (33·3–60·9)
High HDI	354	44·4% (39·2–49·4)	29·4% (24·7–34·2)	26·8% (22·3–31·5)	47·4% (42·2–52·4)	36·1% (30·2–42·0)	39·1% (31·6–46·5)
Medium HDI	91	37·3% (26·2–48·4)	20·6% (11·7–31·2)	13·8% (6·6–23·5)	44·0% (33·3–54·2)	29·3% (18·2–41·3)	22·8% (11·3–36·7)
Low HDI	89	40·2% (29·9–50·3)	16·6% (9·6–25·2)	9·8% (4·5–17·6)	46·5% (34·3–57·8)	21·5% (9·8–36·2)	NA*
Kaposi sarcoma (C46)‡							
All cases	134	73·7%(64·4–80·9)	67·2% (57·3–75·3)	62·0% (51·5–70·8)	76·6% (67·7–83·4)	NA*	NA*
Male	68	74·9% (61·0–84·5)	62·1% (46·4–74·4)	52·9% (36·6–66·8)	77·2% (64·6–85·8)	NA*	NA*
Female	66	72·9% (59·5–82·5)	71·0% (57·5–81·0)	69·1% (55·3–79·3)	76·2% (66·0–83·8)	76·3% (65·3–84·2)	76·1% (64·1–84·5)
Breast (C50)							
Female	2121	84·3% (82·6–85·8)	61·6% (59·4–63·8)	52·3% (49·9–54·6)	86·8% (84·9–88·4)	68·7% (65·9–71·3)	63·5% (59·5–67·2)
High HDI	578	90·8% (88·2–92·9)	79·4% (75·9–82·5)	72·8% (68·9–76·2)	92·8% (89·8–95·0)	86·9% (82·5–90·3)	87·4% (80·0–92·2)
Medium HDI	461	80·3% (76·2–83·8)	53·6% (48·4–58·4)	43·1% (37·9–48·2)	82·6% (78·1–86·4)	59·4% (53·4–64·9)	49·5% (43·0–55·7)
Low HDI	1082	82·1% (79·5–84·3)	53·9% (50·6–57·1)	43·2% (37·9–48·2)	86·1% (83·2–88·6)	61·2% (56·7–65·5)	52·9% (45·6–59·6)

(Table 3 continues on next page)

	Included cases, n	Observed survival, % (95% CI)			Age-standardised net survival, % (95% CI)		
		1 year	3 years	5 years	1 year	3 years	5 years
(Continued from previous page)							
Cervix uteri (C53)							
All cases	1954	69·6% (67·3–71·7)	47·8% (45·3–50·2)	41·6% (39·2–44·0)	72·4% (70·1–74·5)	52·3% (49·4–55·0)	49·3% (46·0–52·4)
High HDI	465	88·8% (85·6–91·4)	75·9% (71·8–79·6)	71·7% (67·3–75·6)	90·2% (86·4–92·9)	81·5% (76·3–85·7)	83·8% (77·1–88·6)
Medium HDI	793	63·2% (59·4–66·6)	40·7% (36·8–44·5)	32·9% (29·1–36·7)	66·2% (62·5–69·6)	44·6% (40·4–48·7)	38·0% (33·5–42·5)
Low HDI	696	61·9% (57·8–65·7)	32·1% (28·2–36·1)	25·1% (21·3–29·1)	66·2% (61·9–70·1)	36·1% (31·2–41·0)	31·9% (26·0–37·9)
Corpus uteri (C54)‡							
All cases	48	80·0% (63·8–89·5)	66·0% (48·6–78·8)	48·4% (30·0–64·5)	80·7% (59·4–91·6)	70·9% (44·2–86·5)	54·7% (28·6–74·8)
Ovary (C48·1–2, C56, C57·0)							
All cases	407	78·9% (74·4–82·6)	64·3% (59·2–68·9)	59·3% (54·0–64·1)	80·1% (75·0–84·2)	71·2% (64·8–76·7)	75·2% (66·8–81·7)
High HDI	226	85·4% (80·1–89·4)	75·2% (69·1–80·3)	70·6% (64·1–76·1)	87·3% (81·1–91·6)	83·8% (75·4–89·5)	90·3% (76·8–96·2)
Medium HDI	76	71·3% (57·7–81·2)	61·1% (46·8–72·6)	54·2% (39·6–66·7)	75·7% (64·8–83·6)	69·1% (55·9–79·0)	NA*
Low HDI	105	68·4% (58·2–76·6)	40·3% (30·3–50·1)	NA*	69·0% (54·4–79·7)	49·7% (34·3–63·4)	NA*
Prostate (C61)							
All cases	1122	71·7% (68·8–74·3)	48·6% (45·5–51·7)	38·8% (35·7–41·9)	76·2% (72·4–79·5)	61·2% (56·8–65·3)	69·2% (63·0–74·6)
High HDI	445	79·1% (75·0–82·6)	56·1% (51·4–60·6)	44·5% (39·8–49·2)	83·8% (77·5–88·6)	67·3% (60·1–73·5)	63·0% (55·1–68·7)
Medium HDI	242	68·1% (61·5–73·7)	47·9% (40·9–54·5)	39·6% (32·7–46·5)	69·6% (62·6–75·5)	60·9% (51·6–69·0)	73·9% (57·5–84·7)
Low HDI	435	65·3% (60·4–69·8)	40·4% (35·4–45·4)	32·0% (27·1–37·1)	71·3% (65·4–76·3)	55·3% (48·0–62·0)	83·5% (63·8–93·0)
Bladder (C67)							
All cases	212	67·7% (60·9–73·6)	48·3% (41·4–55·0)	36·1% (29·5–42·8)	71·5% (64·5–77·3)	56·9% (48·3–64·5)	46·1% (36·9–54·8)
Male	189	68·9% (61·7–75·0)	50·6% (43·2–57·5)	38·2% (31·1–45·3)	73·2% (65·9–79·3)	60·3% (51·1–68·3)	50·0% (39·9–59·3)
Female	23	57·1% (33·8–74·9)	28·6% (11·7–48·2)	17·9% (5·0–37·1)	58·4% (38·7–73·7)	31·3% (18·0–45·6)	21·2% (13·8–29·8)
High HDI	142	73·9% (65·9–80·4)	56·3% (47·8–64·0)	43·2% (34·9–51·2)	79·2% (70·8–85·4)	68·1% (57·4–76·6)	57·8% (45·8–68·0)
Medium HDI	27	53·0% (31·2–70·7)	39·7% (20·3–58·6)	22·1% (8·1–40·4)	58·5% (36·6–75·1)	46·5% (22·8–67·2)	19·1% (9·0–32·2)
Low HDI	43	54·8% (38·7–68·3)	26·2% (14·1–40·0)	22·5% (10·9–36·6)	45·8% (33·8–57·1)	17·8% (9·8–27·5)	NA*
Thyroid (C73)							
All cases	157	88·9% (82·7–92·9)	77·3% (69·8–83·2)	73·4% (65·1–80·1)	87·1% (78·8–92·3)	72·6% (60·4–81·6)	74·1% (58·5–84·6)
Male	24	91·5% (70·0–97·8)	69·7% (46·7–84·3)	NA*	94·7% (73·0–99·1)	75·2% (49·7–89·0)	NA*
Female	133	88·4% (81·4–92·8)	78·7% (70·5–84·9)	74·5% (65·5–81·4)	86·6% (78·0–92·1)	73·3% (57·3–84·1)	74·3% (54·0–86·7)
High HDI	72	88·9% (79·0–94·3)	84·7% (74·1–91·2)	80·2% (68·7–87·8)	NA*	NA*	NA*
Medium HDI	14	92·3% (56·6–98·9)	65·3% (31·4–85·5)	55·9% (24·0–79·0)	NA*	NA*	NA*
Low HDI	71	88·3% (77·9–94·0)	71·1% (58·4–80·5)	NA*	86·5% (69·2–94·4)	62·6% (48·8–73·6)	NA*
Hodgkin disease (C81)†§							
All cases	32	91·7% (70·6–97·9)	65·5% (42·6–81·0)	60·4% (37·5–77·2)	93·4% (75·0–98·4)	67·3% (47·5–81·0)	63·7% (43·6–78·2)
Non-Hodgkin lymphoma (C82–86, C96)							
All cases	454	54·0% (48·8–58·9)	39·0% (33·9–44·1)	33·9% (28·6–39·3)	57·8% (51·5–63·6)	45·2% (37·5–52·5)	39·6% (31·3–47·7)
Male	256	58·6% (51·6–65·0)	43·8% (36·7–50·7)	38·3% (30·9–45·6)	62·6% (54·1–69·9)	53·2% (41·6–63·5)	47·5% (33·5–60·2)
Female	198	48·3% (40·5–55·6)	33·4% (26·1–40·8)	28·8% (21·4–36·6)	52·1% (42·9–60·5)	35·7% (26·5–45·0)	NA*
High HDI	6	83·3% (27·3–97·5)	50·0% (11·1–80·4)	50·0% (11·1–80·4)	NA*	NA*	NA*
Medium HDI	147	62·6% (53·4–70·5)	47·3% (37·7–56·3)	39·8% (30·1–49·3)	69·8% (59·6–78·0)	60·1% (44·0–73·0)	42·3% (30·1–54·0)
Low HDI	301	48·9% (42·5–54·8)	34·7% (28·6–40·8)	30·8% (24·5–37·3)	50·5% (42·6–57·7)	37·9% (29·8–45·9)	37·8% (28·6–46·9)
Leukaemia (C91–95)							
All cases	204	63·0% (55·4–69·6)	45·1% (37·4–52·5)	29·3% (21·5–37·6)	62·9% (55·3–69·6)	42·9% (34·3–51·1)	26·1% (18·1–34·8)
Male	120	62·2% (52·1–70·7)	43·7% (33·7–53·3)	38·3% (28·3–48·1)	59·2% (49·6–67·6)	37·5% (27·4–47·6)	34·1% (23·2–45·3)
Female	84	64·1% (52·1–73·9)	47·2% (35·1–58·4)	17·7% (8·0–30·5)	67·3% (54·8–77·1)	49·6% (35·8–62·0)	17·5% (0·1–29·1)
Medium HDI	95	54·7% (43·7–64·5)	34·0% (24·0–44·3)	17·2% (9·4–27·0)	61·7% (52·4–69·6)	40·0% (28·8–50·8)	21·3% (11·6–32·9)
Low HDI	109	70·6% (60·0–78·8)	55·5% (44·3–65·4)	NA*	64·5% (53·6–73·4)	46·0% (33·5–57·6)	32·7% (20·1–45·9)

HDI=Human Development Index. NA=not available. *Insufficent cases for the estimation of age standardised rates. †Stratification by sex resulted in inadequate number of cases per strata. ‡All cases from a single country. §Stratification by HDI resulted in inadequate number of cases per strata.

Table 3: **Observed and age-standardised net 1-year, 3-year, and 5-year survival by cancer type, HDI, and by sex**


Oral cavity
Males
Females
Observed survival by sex (%)
p=0·981
Oesophagus
p=0·267
Stomach
p<0·0001
Number at risk
Males 99 37 25 22 16 11
Females 24 10 6 5 4 3
417 110 67 53 47 29
467 120 86 70 53 41
322 142 91 74 68 50
225 121 95 82 74 50
Colon and rectum
p=0·758
Liver and intrahepatic bile duct
p=0·508
Larynx
p=0·100
Number at risk
Males 632 411 321 270 227 156
Females 657 418 318 267 225 149
116 24 16 12 10 4
114 25 14 10 9 6
43 16 9 8 4 2
5 3 3 3 3 0
Trachea, bronchus, and lungs
p<0·0001
Kaposi sarcoma
p=0·357
Bladder
p=0·066
Number at risk
Males 367 122 79 71 63 55
Females 167 93 70 59 54 41
68 30 26 23 19 15
66 39 39 36 31 22
189 128 99 93 77 54
23 12 8 6 6 2
Thyroid
p=0·514
Hodgkin disease
p=0·042
Non-Hodgkin lymphoma
p=0·015
Time since diagnosis (years)
Time since diagnosis (years)
Number at risk
Males 24 21 18 15 11 1
Females 133 111 102 95 88 52
16 11 11 8 7 3
16 10 6 6 4 1
256 108 90 73 59 25
198 77 50 36 28 13
Leukaemia
p=0·411
Time since diagnosis (years)
Number at risk
Males 120 59 48 37 25 6
Females 84 45 35 28 14 3

highlights the need for more equitable access to cancer diagnostics and quality care across the continent.

For cancers amenable to treatment and of relatively good prognosis, earlier studies in sub-Saharan Africa have shown the importance of stage at diagnosis and access to care on survival outcomes, with the country-level HDI being a proxy for access to care.[12–15] Of the 11 countries included in this study, in 2015, two were categorised as being of high HDI (Mauritius and Seychelles), three of medium HDI (Kenya, Namibia, and South Africa), and the rest as of low HDI. Although the HDI is a surrogate marker of access to health care, there are patient-level differences that do not correlate with the ecological grouping by HDI. Of the registries included, those of Seychelles and Mauritius are national-level registries, and the rest are urban centres with the exception of the ECCR, which is predominantly rural. Additionally, there were differences in the health systems of these countries with respect to early detection programmes, out-of-pocket costs of diagnostics and care, and access to oncological surgery, radiotherapy or chemotherapy, which are important determinants of cancer survival.[5] In the absence of early detection programmes for the most common cancers in sub-Saharan Africa (breast, cervix, and prostate cancer), among patients with known stage, more than half of them present at advanced stages.[13–15] The cost of treatment for patients with advanced stage cancers was significantly higher than those with less advanced stage cancers, and patients diagnosed with advanced stage cancers had poorer outcomes than those diagnosed at earlier stages.[16]

Our previous publications highlighted the association between receiving guideline-concordant therapy and better survival outcomes for breast cancer,[17] cervical cancer,[18] colorectal cancer,[19] prostate cancer,[20] and for non-Hodgkin lymphoma.[21] However, barriers to accessing the mainstays of cancer therapy, such as surgery, radiotherapy, and chemotherapy persist and could partly explain poor cancer survival in sub-Saharan Africa. Surgery is a mainstay of oncological treatment,[18] but there is an urgent need to improve the surgical infrastructure, oncological surgical training, and availability of integrated pathology services.[19] Similarly, marked disparities remain in access to radiotherapy across the sub-continent,[20] for example, in 2020, radiotherapy capacity per patient was 100 times higher in Mauritius than in Ethiopia.[22] Availability and access to chemotherapy depend on many factors, such as the cost of the treatment to the government or the patient, supply chain management systems, whether there are any drug shortages at the national level, and availability of trained staff.[21,23,24] Kizub and colleagues[16] compared access to and affordability of the 2019 WHO essential medicines for cancer in Kenya, Uganda, and Rwanda and reported that for some cancers, many of the recommended cancer medicines were not available in the public sector, and patients and their families had to pay out-of-pocket expenses to access them in the private sector, which is unaffordable for most of the population.

In the period during which these patients were diagnosed, there was no universal access to health care in many of the countries included in this study, including Kenya, Ethiopia, and Uganda and other sub-Saharan Africa countries. Consequently, a substantial financial burden had to be borne by the patients and their families, and hence the severe financial overload associated with cancer treatment for many patients in sub-Saharan Africa. There are also long waiting periods for cancer care due to shortages of human and material resources. In earlier publications of the AFCRN, we described the therapy received and outcome of therapy for cancers of the breast,[17] cervix,[18] colon-rectum,[19] prostate,[20] and for non-Hodgkin lymphoma.[21] These studies compared the therapy received at the population-level in sub-Saharan Africa with the National Comprehensive Cancer Network resource-stratified therapy guidelines for sub-Saharan Africa and highlighted the importance of access to guideline-concordant therapy for improved survival outcomes. However, patients in sub-Saharan Africa face several challenges in accessing this recommended therapy.

We observed differences in survival by sex for cancers of the stomach, lung, Hodgkin lymphoma, and non-Hodgkin lymphoma. The reasons for differences in cancer survival by sex are poorly understood, but they have been observed in other population-level studies.[23,24] These differences might, in part, be driven by differences in health-care seeking behaviours between men and women, as reported in other studies from sub-Saharan Africa,[25] which could influence early diagnosis and survival. Tobacco use, which is more common among males than females, might explain the poorer survival observed among males with stomach or lung cancer.[26] Differences in cancer survival by ethnicity in Zimbabwe could be explained by the fact that the follow-up of registered cancer cases in Harare showed that many hospital admissions among the white population were to the private sector, with probable better access to care.

Our study had limitations. A relatively high proportion of patients in some registries were lost to follow-up, especially in the first year after diagnosis (appendix 3 p 12). For all 10 500 cases included for survival analyses, 10·0% of cases were lost to follow-up at 1 year after diagnosis, and 4·4% were lost to follow-up in the second and third year after diagnosis, although in five of the 13 registries, the proportion of patients lost to follow-up was less than 0·5% (Abidjan, Mauritius, Seychelles, Nairobi, and Harare). For all registries combined, loss to follow-up was greatest among patients aged 15–44 years (14·3%),

Figure 1: **Observed all-cause cancer survival by sex for all registries combined**
The log-rank tests the difference in survival curve by sex based on a pre-determined significance level of 5%.

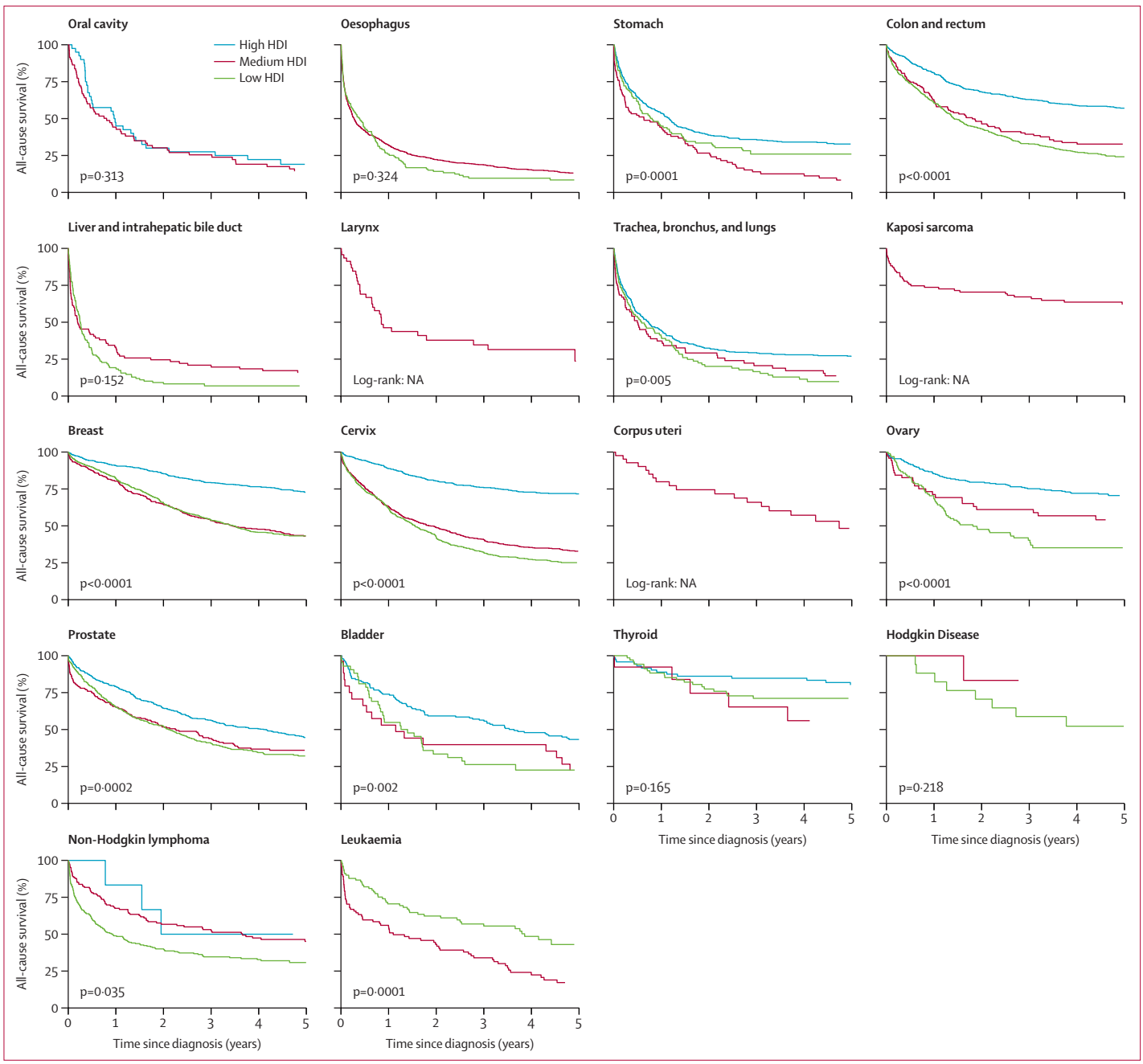


Figure 2: **Observed all-cause cancer survival by country-level HDI for all included registries**
At the country level, Seychelles and Mauritius were categorised as high HDI, Eldoret (Kenya), Nairobi (Kenya), Namibia, and the Eastern Cape Cancer Registry (South Africa) as medium HDI, and Cotonou (Benin), Abidjan (Côte d'Ivoire), Addis Ababa (Ethiopia), Bamako (Mali), Kampala (Uganda), Bulawayo (Zimbabwe), and Harare (Zimbabwe) as low HDI. The log-rank tests the difference in survival curve by country-level HDI based on a pre-determined significance level of 5%. All cases of cancers of the larynx, Kaposi sarcoma, and corpus uteri were from the Eastern Cape Cancer Registry (South Africa). HDI=Human Development Index. NA=not applicable.

and lowest among older patients aged 75 years and older. If younger patients emigrated for better management elsewhere, depending on the prognosis, stage, and biology of the tumours, this could influence the estimated survival outcomes. Only one registry (Mauritius) relied entirely on passive follow-up (linkage with death certificates) to ascertain vital status and identify cases who had died. This method potentially biases survival upwards, if there is a failure of record linkage, or cancer cases have migrated out of the registry area before dying. However, active follow-up was done for a 10% random sample of the cancer cases who were alive as per passive follow-up in Mauritius, none of whom had died.

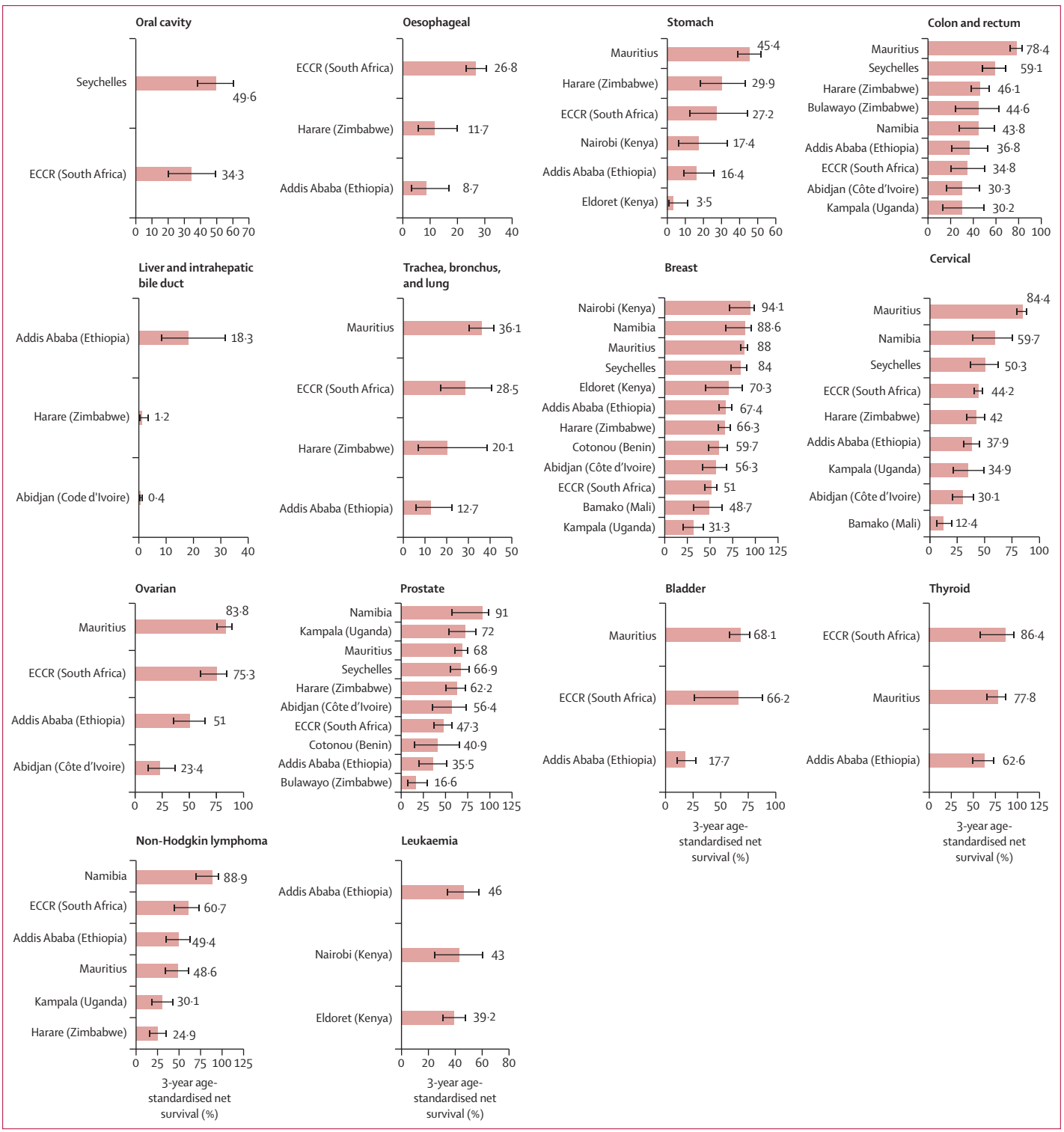


Figure 3: **3-year age-standardised net survival by cancer type, Human Development Index, and registry**
Error bars show 95% CIs. ECCR=Eastern Cape Cancer Registry.

There are no robust vital registration systems for the majority of the included registries and, as such, there might be a higher number of fatal cases. which would lead to an overestimation of survival estimates. However, we included death-certificate initiated cases, those identified because of a death registration, implying that

the registry was missing non-fatal cases. This would have the opposite effect of decreasing survival estimates.[27] Prospective studies, with real-time data collection and the use of mobile technology, have been shown to help improve the completeness of the collected data.[28]

In the SURVCAN-3 study, no systematic attempt was made to collect data on the stage at diagnosis for all cancer sites, so it was not possible to estimate survival according to the stage at diagnosis. However, data on stage at diagnosis, and survival by stage for cancers of the breast, cervix, prostate, and colon-rectum for some of the patients included in this cohort, have been published in previous papers by the AFCRN.[12–15]

Despite the limitations of our study, the SURVCAN-3 project has increased the availability and breadth of data on cancer survival outcomes in low-income and middle-income countries. Based on this study in sub-Saharan Africa, survival after cancer diagnosis was poor for most cancer types studied: less than half of patients remained alive 3 years after cancer diagnosis. Our earlier study has shown marked differences in survival in sub-Saharan Africa as compared with other world regions,[5] which could be due to many factors, particularly late stage at diagnosis. There are ongoing efforts to address this issue[29] so that in future the availability of stage-specific survival will allow better identification of other factors leading to the disparities in cancer survival that were observed between countries, notably the availability of, and access to, adequate cancer-directed therapy. There are well documented deficiencies in availability of and access to cancer therapy in sub-Saharan Africa, although in our study, only the country-level HDI was available as a weak proxy measure, suggesting the potential to improve survival and reduce mortality from cancer by increasing investment in health systems to encourage early detection and increase access to adequate treatment. In any case, our results provide a benchmark against which progress in cancer control interventions can be assessed.

Contributors

All authors had full access to all the data in the study and the corresponding author had final responsibility for the decision to submit for publication. WYJ-F, AB, BL, IS, and DMP accessed and verified the data. WYJ-F conceptualised the study, did formal analysis, and was involved in methodology, software, validation, visualisation, writing the original draft, and reviewing and editing the manuscript. AB did formal analysis, and was involved in methodology, project administration, software, and writing, reviewing, and editing the manuscript. PB, SA, GN, EW, GC, AK, BL, MK, RH, AF, NS, EC, and TC contributed to data curation, investigation, and writing, reviewing, and editing the manuscript. BL was involved in project administration, and writing, reviewing, and editing the manuscript. EJK was involved in funding acquisition, project administration, supervision, and writing, reviewing, and editing the manuscript. DMP conceptualised the study, and was involved in investigation, methodology, supervision, and validation and writing, reviewing, and editing the manuscript. IS conceptualised the study, and was involved in investigation, methodology, supervision, and validation, and writing, reviewing, and editing the manuscript.

Equitable partnership declaration

The authors of this paper have submitted an equitable partnership declaration (appendix 4). This statement allows researchers to describe how their work engages with researchers, communities, and environments in the countries of study. This statement is part of *The Lancet* journals' broader goal to decolonise global health.

See Online for appendix 4

Declaration of interests

We declare no competing interests. Where authors are identified as personnel of the International Agency for Research on Cancer and WHO, the authors alone are responsible for the views expressed in this Article and they do not necessarily represent the decisions, policy, or views of the International Agency for Research on Cancer and WHO.

Data sharing

All data are publicly available at https://gco.iarc.fr.

Acknowledgments

Vital Strategies, the Martin-Luther-University Halle-Wittenberg, and the International Agency for Research on Cancer have kindly provided funding for the project.

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