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The incidence of oesophageal cancer in Eastern Africa: Identification of a new geographic hot spot?

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Abstract

The incidence of oesophageal cancer (OC) varies geographically, with more than 80% of cases and deaths worldwide occurring in developing countries. The aim of this study is to characterize the disease burden of OC in four urban populations in Eastern Africa, which may represent a previously undescribed high-incidence area. Data on all cases of OC diagnosed between 2004 and 2008 were obtained from four population-based cancer registries in: Blantyre, Malawi; Harare, Zimbabwe; Kampala, Uganda; and Nairobi, Kenya. Age-standardized incidence rates (ASRs) were calculated for each population, and descriptive statistics for incident cases were determined. In Blantyre, 351 male (59%) and 239 (41%) female cases were reported, with ASRs of 47.2 and 30.3. In Harare, 213 male (61%) and 134 (39%) female cases were reported, with ASRs of 33.4 and 25.3, respectively. In Kampala, 196 male (59%) and 137 female (41%) cases were reported, with ASRs of 36.7 and 24.8. In Nairobi, 323 male (57%) and 239 female (43%) cases were reported, with ASRs of 22.6 and 21.6. Median age at diagnosis was significantly different among the four populations, ranging from 50 years in Blantyre to 65 years in Harare ($p < 0.0001$). Except

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Authorship Contributions

Study conception and design: DMP, KVL

Acquisition of data: MB, EC, CD, AK, HRW, DMP

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in Nairobi, incidence among males was significantly higher than among females ($p<0.01$). Squamous cell OC was the predominant histologic subtype at all sites. ASRs at all four sites were remarkably higher than the mean worldwide ASR. Investigation to evaluate potential etiologic effects of dietary, lifestyle, environmental, and other factors impacting the incidence in this region is needed.

Keywords

oesophageal cancer; Africa; incidence rate

INTRODUCTION

The mean worldwide age-standardized incidence rates (ASRs) for oesophageal cancer (OC) were estimated in 2012 to be 9.0 in males and 3.1 per 100,000 in females [1]. However, this statistic does not reflect remarkable geographic variations in incidence rates. Currently, more than 80% of cases and deaths from OC occur within developing countries [1]. One of the most striking features of OC is the presence of high-incidence geographic regions, which have been previously identified in locales including northern China, Northeastern Iran, Eastern South America, and South Africa [2,3]. Even within Africa, incidence rates for OC may vary widely; GLOBOCAN 2012 reported an ASR of 9.7 in Eastern Africa, compared to ASRs of 0.6 and 2.2 in Western and Northern Africa [1].

Both scattered historic reports and emerging descriptive data suggest that high-incidence geographic areas may be present in Eastern Africa. Western Kenya was reported as a high-incidence region for OC as early as the 1960's [4], and more recent data published by the Nairobi Cancer Registry reported OC to be the most common site of cancer among men from 2000 to 2002, accounting for 10% of all pathologically confirmed malignancies [5]. The Zimbabwe National Cancer Registry reported ASRs for OC in the black males and females of Harare ranging from 18.9 to 24.6 between 1991 and 2010 [6]. The cancer registry of Kyadondo County, Uganda reported OC to be the second most common cancer amongst men between 1981 and 1991, second only to Kaposi's sarcoma [7]. At a tertiary care center in Bomet, Kenya, a hospital-based retrospective review of all pathologically confirmed malignancies between 1999 and 2007 reported that OC accounted for 34.6% of all newly diagnosed cancers, with increasing trends over time and disproportionate numbers in very young patients [8].

OC has potential to represent a tremendous burden to healthcare systems throughout Eastern Africa. However, due to the inadequacies and outdated nature of existing data, current ASRs for this region of the world are largely unknown. Data regarding the current disease burden, time trends, and risk factors are required to direct investigations of etiology and to begin building capacity to provide effective oncologic care for this disease. Characterization of the magnitude of this problem will be a first step towards systematically defining the nature of the disease burden from OC. In an effort to further define the incidence of OC in Eastern Africa, we report data on OC from population-based cancer registries representing four urban areas in Eastern Africa.

METHODS

Study Population

Four population-based cancer registries within Eastern Africa, as demarcated by the geographical definition of the United Nations, were identified as having registry data available beginning in 2004 or earlier. The Kampala Cancer Registry was established in 1954 as a population-based cancer registry at the Department of Pathology, Makerere University College of Health Sciences, and collects data on the population of the surrounding area in Kyadondo County, Uganda. The Zimbabwe Cancer Registry was established in 1985 and is housed in the Parirenyatwa Group of Hospitals in Harare, which provides most of the specialized cancer care for northern Zimbabwe and is one of two teaching hospitals of the University of Zimbabwe's College of Health Sciences. The Nairobi Cancer Registry was established in 2001 and is situated at the Centre for Clinical Research (CCR), Kenya Medical Research Institute (KEMRI) headquarters, Nairobi. The Malawi National Cancer Registry was established in 1989 and expanded in 1993 to incorporate a population-based registry for the Blantyre District.

As member organizations of the African Cancer Registry Network (AFCRN), each met membership criteria by achieving 70% coverage of its target population and agreed to participate in a retrospective review of all cases of OC reported between 2004 and 2008. Participating registries provided data from four major urban areas in Eastern Africa: Blantyre, Malawi; Harare, Zimbabwe; Kampala, Uganda; and Nairobi, Kenya. All are capital cities with the exception of Blantyre, which is the largest city and center of commerce and finance in Malawi. This project was sanctioned and approved by the Research Committee of AFCRN. It was also approved by the Committee on Human Research at the University of California, San Francisco (IRB #13-11275).

Government-sanctioned population censuses were performed in Blantyre in 1998 and 2008 [9]; Harare in 1992, 2002, and 2012 [10]; Kampala in 1991 and 2002 [11]; and in Nairobi in 1999 and 2009 [12]. For these years, data regarding the four populations are available according to sex and five-year age group. Annual intercensal estimates were prepared. We assumed the following: (1) a constant rate of growth within age groups, for both males and females, between census counts; and (2) that the age distribution following the most recent census remains the same in subsequent years.

Data Collection

All registries employ a combination of active and passive case finding, with staff that travel to institutions within the healthcare delivery system of their respective catchment areas. Each registry also relies on voluntary notifications from participating institutions, because cancer is not mandated by the respective governments as a reportable disease. Data regarding cancer cases are abstracted from a variety of sources, including, but not limited to, pathology reports, inpatient and outpatient medical records, and death registries. Cancer notification forms were completed for each identified case and populated with information that included patient demographic data (names, date of birth or age, gender, race, and permanent residential address). Basic data on initial treatment and follow-up data were also

collected, when available. The abstracted forms were coded and entered into the CanReg4[©] or CanReg5[©] cancer registration software (International Agency for Research on Cancer, Lyon, France). Tumor site and morphology were coded according to the third edition of the International Classification of Diseases (ICD) for Oncology [13].

Statistical methods

Frequency distributions and medians were used to describe subject demographics and baseline characteristics for categorical and continuous variables, respectively. Univariate analyses among variables were assessed using the two-sample t-test, Wilcoxon-rank-sum test, Chi-square test, as appropriate. Statistical significance was declared based on alpha level of 0.05. All statistical analyses were performed by using R statistical software (<http://www.r-project.org>) [14].

For the purpose of comparing several populations that differ with respect to age structure and accounting for the powerful influence of age on cancer, ASRs were calculated by applying the observed age-specific rates in a reference population, the world standard population [15]. Adjusted age-standardized rates (AASR's) were calculated to account for missing data on age in three of the four registries [16]. Age data were missing for 17.6% of cases from Blantyre; 1.2% of cases from Harare; 4.5% of cases from Kampala; and 0% of cases from Nairobi.

The standard error of the ASR was calculated. Using the estimates of ASRs and their standard errors, we compared two age-standardized rates, ASR_1 and ASR_2 , for males and females, respectively. A standardized rate ratio (SRR) was calculated as the ratio of ASR_1 to ASR_2 for each population. If the SRR did not include 1, the standardized rates ASR_1 and ASR_2 were considered significantly different at the significance level of alpha (0.05). For detailed information regarding the statistical methods applied, please refer to Supplement A.

RESULTS

Patient characteristics

A total of 1,832 cases of OC were reported by the four participating cancer registries during the years 2004–2008. The baseline characteristics of OC cases reported by each of the four cancer registries are summarized in Table 1. The median age at diagnosis was significantly different among the four populations, ranging from 50 years in Blantyre, Malawi to 65 years in Harare, Zimbabwe ($p < 0.0001$). The age distributions of cases for each population are shown in Figure 1. Overall, 59% of all OC cases were male, with similar male predominance seen in each of the individual populations (range 57 to 61%).

Only 42% of all cases classified as OC by the registries were pathologically confirmed, and the remainder of cases was identified either by clinical diagnosis (including endoscopic or radiographic findings) or by death certificate reporting. The proportion of cases that were diagnosed based upon pathologic findings varied widely across sites. Only 14% of cases were pathologically confirmed in Blantyre, compared to 86% of cases in Nairobi ($p < 0.0001$). Of the 764 total cases that were pathologically confirmed, 87% were SCC.

Incidence rates

Table 2 summarizes the ASRs and AASRs for each site during 2004–2008, as well as their standard errors. In Blantyre, the ASR was 55.9 for males, and 30.3 for females. In Kampala, Uganda, the ASR was 36.7 for males and 24.8 for females. In Harare, Zimbabwe, the ASR was 33.4 in males and 25.3 in females. In Nairobi, the ASR was 22.6 in males, and 21.6 in females. The AASRs, were higher for the Blantyre population (55.9 in males and 38.1 in females) and comparable for the others. Figure 2 reports the SRRs for male vs. female incidence, which ranged from 1.05 in Nairobi to 1.56 in Blantyre. Figure 3 displays age-specific incidence rates for each population.

Time trends

Partial historical incidence data are available from each of the registries, except Nairobi. Figure 4 shows the time trends in incidence from 1991–2010 for Harare and Kampala, and 1998–2008 for Blantyre.

DISCUSSION

Elevated rates of OC have been described in studies focusing on single locations throughout Eastern Africa. However, this is the first study to evaluate population-level data for multiple urban centers. Our findings demonstrate high ASRs for OC in each of the four large urban populations, each with ASRs for males and females that are dramatically higher than the estimated mean worldwide ASRs. Moreover, these findings are also higher than the current estimated ASRs for Eastern Africa overall, as published by GLOBOCAN 2012 (11.9 in males and 7.8 in females) [1], suggesting that these urban centers represent remarkably high-incidence geographic areas.

Several unique aspects of these data are worth highlighting. First, increasing age was associated with an increased risk of OC in all populations. Amongst individuals between the ages of 70 and 74 ASRs exceeding 100 per 100,000 were seen in all four populations (100.9 – 165.6). Given the anticipated growth and aging of the population over the ensuing decades, these results reinforce the need to prioritize OC in national cancer control plans. As shown in Figure 3, the Blantyre, Malawi population was uniquely notable for a high number of younger cases, diagnosed between ages 25 and 45 years, than was seen in the other three populations. The SRRs for male versus female cases were significantly >1 in all populations, except Nairobi. However, all the ratio of rates between male and females were notably lower than that of developed countries, consistent with previous observations in Africa [8].

In industrialized countries, chronic gastroesophageal reflux, Barrett's esophagus, and obesity are considered risk factors for oesophageal adenocarcinoma, which is the histologic variant primarily affecting white populations in the developed world. In Eastern Africa, oesophageal squamous cell carcinoma (SCC) is the dominant histology. Studies of SCC of the oesophagus in developed countries have consistently shown the effects of tobacco and alcohol as compounding risk factors; however, despite increasing Western influences, tobacco use in Eastern Africa and in African-American populations in the U.S. remains low [17]. Reports of tobacco use among men in the four sites range from 9.2% in Blantyre [18]

to 23.9% in Nairobi [19]. Women in Eastern Africa rarely use tobacco, with rates ranging from 0.4% in Harare [20] to less than 3% in Nairobi [19]. Alcohol consumption has been previously reported as common among diverse groups of young people in Eastern Africa and merits exploration as a potential risk factor in this setting [21]. Possible environmental or dietary associations that might contribute to geographic variations in incidence also merit further exploration, including, but not limited to: mineral or nutritional deficiencies, lack of protective effect of fresh fruits and vegetables, dietary contamination, or viral infection [22–26].

Additionally, HIV/AIDS remains an important co-morbidity in Eastern Africa populations. Recent data from cancer registries in the U.S. suggest increased risks of both oesophageal adenocarcinoma and squamous cell carcinoma in people with AIDS [27]. One study in Uganda, which linked cancer registry data to HIV registry data, did not suggest any increase in incidence of OC in persons with HIV/AIDS [28]. Additional studies, which attempt to link OC cases in Eastern Africa to HIV status, are warranted to validate this finding.

Finally, it has also been speculated that increasing Westernization may contribute to increasing rates of OC. However, for the two cancer registries with historic data from the two previous decades available for comparison (Harare and Kampala), minimal changes in rates over time argue against new exposure(s) as contributing to etiology. Moreover, the distinct histologic predominance of SCC in the Eastern African populations argues against influence from chronic gastroesophageal reflux, Barrett's esophagus, and obesity, which are increasingly prevalent in Westernized societies and commonly associated with oesophageal adenocarcinoma. Acknowledging the limitations of our data on historic trends, the overall stability of ASRs in two sites dating back to 1990, despite increasing Western influences, may direct future investigation to evaluate environmental exposures in this region, which have remained static over time. There is, however, some evidence that rates have increased from earlier times; data from the Kampala Cancer Registry (established in 1954) reported a marked increase in ASRs for cancer of the oesophagus amongst males from 1.7 in the 1960's to an ASR of 13 in the 1990's [29].

Additional limitations of this study must also be acknowledged. First, obtaining comprehensive and reliable cancer registry data remains a daunting undertaking. Cancer cases are poorly classified by cancer registries in sub-Saharan Africa, and even common cancers may be underreported [30]. The urban cancer registries included in this study are at varying stages in their development, and each faces unique challenges. While each registry met the AFCRN requirement for 70% coverage, these data may represent underestimates of the true disease burden of OC if the registries did not collect data for the entire population of the catchment area. Alternatively, short-term migration of cases from rural to urban areas for access to medical care in the setting of a suspected life-threatening illness could introduce bias, resulting in over-estimation of cases for the local urban population. Finally, gender bias in access to health care could be in part responsible for the higher ASRs amongst males; however, a previous finding that males in Tanzania are actually less likely to visit the care and treatment clinics due to perception that this signifies a display of weakness argues against this [31].

Because population-based registration is dependent upon retrospective data abstraction using multiple sources, including clinical and pathologic records, the availability of services in a resource-limited setting influences the case mix seen in the clinical setting. In particular, this is evidenced by the variable reliance of the registries on pathologic data for case ascertainment. With the exception of Nairobi, where 86% of cases were pathologically confirmed, these data are subject to misclassification bias given the preponderance of cases that were registered based upon clinical suspicion alone; this likely reflects limitations in diagnostic resources. The limited proportion of pathologic diagnoses in Blantyre, Harare, and Kampala (14–30%) underscores that pathology services are not sufficient to provide adequate services in this and other parts of Africa. Pathologist availability in each of the four participating sites is estimated to be less than one per million population [32], by contrast to more than 60 pathologists per million population in the U.S. [33]. This statistic is most pronounced for the country of Malawi, where the population per pathologist is estimated to exceed 4 million. Moreover, the trends in incidence reported here may be confounded by limited improvements in diagnostic capabilities and increasing cancer awareness in sub-Saharan Africa during recent years.

We also must mention that data for Harare, Zimbabwe were incomplete between the years 2007 and 2009 due to the impact of severe economic challenges resulting in near collapse of the public sector's healthcare delivery system; as a result, data were estimated for this period. However, cancer rates for 2010 were reported as within the expected range according to pre-existing trends, indicating reasonable preservation of data quality [6].

Finally, in consideration of the well-described sharp geographic gradients that are associated with high-incidence populations of OC, the generalizability of these findings to non-urban and even other urban populations in Eastern Africa is unknown. Eastern Africa may be another OC high incidence geographic region, but even across these four urban populations, we detected unique patterns of OC incidence, with regards to age, histology, and gender. This suggests that each of these four populations may be subject to unique risk factors and that findings from single-site etiologic studies may not be generalizable across sites.

Conclusion

The International Agency for Research on Cancer has historically relied on data from only two countries (Uganda and Zimbabwe) to describe OC incidence for all of Eastern Africa [34], reflecting how little was previously understood regarding the burden of disease from OC for this entire region. While we acknowledge that the data presented here are limited by challenges affecting each of the individual cancer registries, this represents the most comprehensive picture of the burden of disease from OC in Eastern Africa available to date and the only data comparing rates across different urban sites. The recognition of Eastern Africa as another high-incidence region for OC is a critical first step towards characterizing the magnitude of this problem. Prospective studies to identify etiologic factors contributing to the disproportionately high incidence of this disease in Eastern Africa are badly needed. Our findings of variation and unique incidence patterns among the four sites suggests that while the high incidence of OC may be common to this region, smaller geographic areas

within Eastern Africa may be subject to unique influences. Thus, future prospective studies to evaluate etiology should ideally involve comparisons across multiple sites.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Ferlay, J.; Soerjomataram, I.; Ervik, M.; Dikshit, R.; Eser, S.; Mathers, C., et al. GLOBOCAN 2012 v1.0, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 11 [Internet]. Lyon, France: International Agency for Research on Cancer; 2013.
2. Islami F, Kamangar F, Nasrollahzadeh D, Møller H, Boffetta P, Malekzadeh R. Oesophageal cancer in Golestan Province, a high-incidence area in northern Iran - a review. *Eur J Cancer*. 2009; 45:3156–65. [PubMed: 19800783]
3. Sumeruk R, Segal I, Te Winkel W, van der Merwe CF. Oesophageal cancer in three regions of South Africa. *S Afr Med J*. 1992; 81:91–3. [PubMed: 1733032]
4. Ahmed N, Cook P. The incidence of cancer of the oesophagus in West Kenya. *Br J Cancer*. 1969; 23:302–12. [PubMed: 5788038]
5. Kenya Medical Research Institute (KEMRI). [Accessed October 2013] Cancer Incidence Report Nairobi 2000–2002. Available at www.kemri.org
6. Chokunonga E, Borok MZ, Chirenje ZM, Nyakabau AM, Parkin DM. Trends in the incidence of cancer in the black population of Harare, Zimbabwe 1991–2010. *Int J Cancer*. 2013; 133:721–9. [PubMed: 23364833]
7. Wabinga HR, Parkin DM, Wabwire-Mangen F, Mugerwa JW. Cancer in Kampala, Uganda, in 1989–91: changes in incidence in the era of AIDS. *Int J Cancer*. 1993; 54:26–36. [PubMed: 8478145]
8. White RE, Abnet CC, Mungatana CK, Dawsey SM. Oesophageal cancer: a common malignancy in young people of Bomet District, Kenya. *Lancet*. 2002; 360:462–3. [PubMed: 12241722]
9. National Statistical Office of Malawi (NSO). [Accessed October 2013] Population and Housing Census Main Report. 2008. Available at www.nsomalawi.mw
10. Zimbabwe National Statistics Agency (ZIMSTAT). [Accessed October 2013] Census 2012 Preliminary Report. Available at www.zimstat.co.zw
11. Uganda Bureau of Statistics (UBOS). [Accessed October 2013] Census Results Report. 2002. Available at www.ubos.org
12. Population and Housing Census. [Accessed October 2013] Kenya National Bureau of Statistics. 2009. Available at www.knbs.or.ke

13. Fritz, A.; Percy, C.; Jack, A.; Shanmugaratnam, K.; Sobin, L.; Parkin, DM., et al. International Classification of Diseases for Oncology. 3. Geneva: World Health Organization; 2000.
14. R Core Team. R: A Language and Environment for Statistical Computing, 2013-05-16 ed. Vienna: R Foundation for Statistical Computing; 2013.
15. Ahmad, O.; Boschi-Pinto, C.; Lopez, A.; Murray, C.; Lozano, R.; Inoue, M. Age standardization of rates: a new WHO standard. Geneva: World Health Organization; 2001.
16. Doll, R.; Smith, PG. Comparison between registries: Age-standardized rates. In: Waterhouse, J.; Muir, C.; Shanmugaratnam, K.; Powell, J., editors. Cancer Incid Five Cont Vol IV (IARC Sci Publ No 42). Lyon: International Agency for Research on Cancer; 1982. p. 671-4.
17. Kabat GC, Shivappa N, Hébert JR. Mentholated cigarettes and smoking-related cancers revisited: an ecologic examination. Regul Toxicol Pharmacol. 2012; 63:132–9. [PubMed: 22429780]
18. National Statistical Office of Malawi (NSO). [Accessed October 2013] Third Integrated Household Survey (IHS3) Main Report. Available at www.nsomalawi.mw
19. Kenya Demographic and Health Survey. [Accessed October 2013] Kenya National Bureau of Statistics. 2008. Available at www.knbs.or.ke
20. Zimbabwe National Statistics Agency (ZIMSTAT). [Accessed October 2013] Zimbabwe Demographic and Health Survey 2005–2006. Available at www.zimstat.co.zw
21. Francis JM, Grosskurth H, Changalucha J, Kapiga SH, Weiss HA. Systematic review and meta-analysis: prevalence of alcohol use among young people in eastern Africa. Trop Med Int Health. 2014; 19:476–88. [PubMed: 24479379]
22. Vaughan TL, Davis S, Kristal A, Thomas DB. Obesity, alcohol, and tobacco as risk factors for cancers of the esophagus and gastric cardia: adenocarcinoma versus squamous cell carcinoma. Cancer Epidemiol Biomarkers Prev. 1995; 4:85–92. [PubMed: 7742727]
23. Parkin, D.; Ferlay, J.; Hamdi-Chérif, M.; Sitas, F.; Thomas, J.; Wabinga, H., et al. IARC Scientific Publications No 153. Lyon: International Agency for Research on Cancer; 2003. Cancer in Africa Epidemiology and Prevention.
24. Marasas WF. Discovery and occurrence of the fumonisins: a historical perspective. Environ Health Perspect. 2001; 109 (Suppl):239–43. [PubMed: 11359691]
25. Van Rensburg SJ, Benadé AS, Rose EF, du Plessis JP. Nutritional status of African populations predisposed to esophageal cancer. Nutr Cancer. 1983; 4:206–16. [PubMed: 6844145]
26. Cook-Mozzaffari, P. Epidemiology and predisposing factors. In: Hurt, RL., editor. Manag Oesophageal Cancer. London: Springer London; 1989.
27. Persson EC, Shiels MS, Dawsey SM, Bhatia K, Anderson LA, Engels EA. Increased risk of stomach and esophageal malignancies in people with AIDS. Gastroenterology. 2012; 143:943–950. e2. [PubMed: 22796240]
28. Mbulaiteye SM, Katabira ET, Wabinga H, Parkin DM, Virgo P, Ochai R, et al. Spectrum of cancers among HIV-infected persons in Africa: the Uganda AIDS-Cancer Registry Match Study. Int J Cancer. 2006; 118:985–90. [PubMed: 16106415]
29. Wabinga HR, Parkin DM, Wabwire-Mangen F, Namboozee S. Trends in cancer incidence in Kyadondo County, Uganda, 1960–1997. Br J Cancer. 2000; 82:1585–92. [PubMed: 10789729]
30. Rebbeck TR, Devesa SS, Chang B-L, Bunker CH, Cheng I, Cooney K, et al. Global patterns of prostate cancer incidence, aggressiveness, and mortality in men of african descent. Prostate Cancer. 2013; 2013:560857. [PubMed: 23476788]
31. Nyamhanga TM, Muhondwa EPY, Shayo R. Masculine attitudes of superiority deter men from accessing antiretroviral therapy in Dar es Salaam, Tanzania. Glob Health Action. 2013; 6:21812. [PubMed: 24152373]
32. Adesina A, Chumba D, Nelson AM, Orem J, Roberts DJ, Wabinga H, et al. Improvement of pathology in sub-Saharan Africa. Lancet Oncol. 2013; 14:e152–7. [PubMed: 23561746]
33. Smart, D. Physician Characteristics and Distribution in the US. Chicago: American Medical Association; 2011.
34. Curado, M.; Edwards, B.; Shin, H.; Storm, H.; Ferlay, J.; Heanue, M., et al., editors. Cancer Incidence in Five Continents. Vol. IX. Lyon: International Agency for Research on Cancer; 2007.

Highlights

- Four cancer registries in Eastern Africa detected high incidence rates for oesophageal cancer.
- Age-standardized incidence rates (ASRs) at all sites were remarkably higher than the mean worldwide ASR for both males and females.
- Squamous cell OC was the predominant histologic subtype at all sites.
- This is a novel report of Eastern African as another high incidence area for OC.
- Further research is needed to confirm the findings and to evaluate possible etiologic factors.

Figure 1.
Age distribution for cases of oesophageal cancer, for four population-based cancer registries in Eastern Africa, 2004–2008.

Figure 2. Standardized rate ratios (SRRs) for oesophageal cancer in males versus females in four urban populations in Eastern Africa, 2004–2008.

Figure 3. Age-specific incidence rates for oesophageal cancer for four population-based cancer registries in Eastern Africa, 2004–2008.

Figure 4.

Trends in ASRs for oesophageal cancer over time from four population-based cancer registries in Eastern Africa, 1990–2012.

* Dashed lines represent best estimates during periods when quality of data collection by the cancer registry was known to be compromised due to various factors.

Characteristics of all cases of oesophageal cancer reported to four urban, population-based cancer registries in Eastern Africa, 2004–2008

Table 1

	Blantyre		Harare		Kampala		Nairobi		p-value
No. of cases	590		347		333		562		
Median age	50		65		60		56		<0.0001
	N	%	N	%	N	%	N	%	
Gender									0.703
Male	351	59%	213	61%	196	59%	323	57%	
Female	239	41%	134	39%	137	41%	239	43%	
Morphology									<0.0001*
Adenocarcinoma	0	0%	19	5%	7	2%	60	11%	
SCC	80	14%	71	20%	83	25%	337	60%	
Unknown/other	510	86%	257	74%	243	73%	165	29%	
Basis of diagnosis									<0.0001*
Clinical	505	86%	209	60%	198	59%	73	13%	
Pathologic	82	14%	96	28%	101	30%	485	86%	
Death certificate	3	1%	42	12%	34	10%	0	0%	
Unknown	0	0%	0	0%	0	0%	4	1%	

* Test doesn't include the data of "Unknown" category.

Data on the incidence of oesophageal cancer in four population-based cancer registries in Eastern Africa, 2004–2008

Table 2

	Male				Female			
	Cases	ASR*	AASR*	SE	Cases	ASR*	AASR*	SE
Blantyre, Malawi	351	47.2	55.9	3.0	239	30.3	38.1	2.4
Kampala, Uganda	196	36.7	38.9	2.9	137	24.8	25.5	2.2
Nairobi, Kenya	323	22.6	22.6	1.6	239	21.6	21.6	1.6
Harare, Zimbabwe	213	33.4	33.6	2.5	134	25.3	25.9	2.4

* Per 100,000.

Abbreviations: ASR = age-standardized rate; AASR = Adjusted age-standardized rates; SE = standardized error.