BMJ Open

Oesophageal cancer and its associated factors among patients attending surgical and oncology clinics at Garissa County Referral Hospital, Kenya: a case–control study

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To cite: Bashir A, Ngari M, Otieno B, *et al*. Oesophageal cancer and its associated factors among patients attending surgical and oncology clinics at Garissa County Referral Hospital, Kenya: a case–control study. *BMJ Open* 2025;**15**:e097376. doi:10.1136/bmjopen-2024-097376

► Pre-publication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2024-097376).

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Received 01 December 2024
Accepted 14 October 2025

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ABSTRACT

Background Oesophageal cancer (EC) is a common cause of cancer mortality. Evidence on the burden, risk factors and treatment outcomes is limited in low-income and middle-income countries. This study aimed to describe the features of EC cases and determine associated factors among patients attending surgical and oncology clinics in Garissa County Referral Hospital (GCRH).

Methods We conducted a case–control study in which cases were patients with EC and positive histological confirmation and controls were patients admitted to GCRH for other diseases. Data on exposures were extracted from patient files. Data on tobacco and alcohol use were based on current or past use as documented in the records; hot tea intake referred to habitual consumption. Mixed-effect logistic regression model was used to determine EC-associated factors.

Results 141 cases and 282 controls were recruited. Of the 141 cases, 59 (42%) had cancer in the lower third of the oesophagus, whereas 72 (51%) and 10 (7%) had cancers in the middle and upper thirds, respectively. EC was associated with tobacco use (adjusted OR (AOR), 21.02, 95% CI 5.41 to 81.69), consumption of hot tea (AOR 59.87, 95% CI 5.45 to 657.35), chewing khat (miraa, AOR 9.94, 95% CI 3.59 to 27.52), gastro-oesophageal reflux disease (GERD) (AOR 54.12, 95% CI 24.48 to 119.62), gastritis (AOR 17.89, 95% CI 2.94 to 108.989) and peptic ulcer disease (PUD) (AOR 69.31, 95% CI 14.09 to 340.9). Among the case group, 95 (65%) had surgery or gastrostomy tube placement as treatments for EC.

Conclusion The study findings highlight modifiable risk factors for EC, including tobacco use, hot tea consumption, chewing miraa, GERD, gastritis and PUD. Targeted screening of high-risk patients may improve early detection and outcomes.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Histological confirmation of oesophageal cancer cases ensured diagnostic accuracy.
⇒ The retrospective review design enabled the inclusion of 3 years of clinical data.
⇒ The use of multilevel modelling accounted for clustering by county.
⇒ Exposure data relied on self-reports, subject to recall bias.
⇒ Binary coding may have reduced precision in exposure assessment.

INTRODUCTION

Oesophageal cancer (EC) is the seventh most common cancer and the 10th common cause of cancer-related mortality worldwide.[1] In low-income and middle-income countries (LMICs), EC accounts for over 80% of global cases.[2] EC has a very poor prognosis, with as high as 88.9% mortality, which is higher in Africa (97.2%) than elsewhere.[1] EC is the fifth leading cause of cancer-related mortality[3] in East Africa, which is considered one of the geographic hotspots. In 2019, the pooled incidence rate for EC in Kenya was 28.7 per 100 000 person-years.[1]

Patients with EC are asymptomatic in early stages but present with dysphagia as the disease progresses. Despite advances in technology, such as the use of radiomic features and machine learning applications for early diagnosis and prognosis prediction, in Africa, >90% of cases still present with advanced disease, when only palliative care is possible.[4] When detected early, EC is treatable through radiotherapy, stenting, endoscopic pulsion intubation, chemotherapy and oesophagectomy. The treatment methods have varying survival rates, with surgery as the most preferred in early stages, whereas chemotherapy and radiotherapy are preferred in late stages.[5]

EC-associated factors from previous studies include the use of tobacco products (smoking), drinking hot beverages (tea/

coffee), heavy alcohol consumption, HIV infection, cooking with firewood/charcoal, poor oral health, low socioeconomic status, eating red meat and low intake of fresh fruit and vegetables.[6] Despite these factors being common in Kenya, most studies have focused on developed countries or urban areas. Only a handful of Kenyan studies, mostly conducted in western Kenya, have investigated EC-associated risk factors.[7 8] However, none has focused on rural northeastern regions such as Garissa, where genetic–environment interactions may differ. Furthermore, there exist misconceptions on the cause of EC in eastern Kenya; therefore, establishing risk factors in this setting is crucial in dispelling these misconceptions. This study aimed to describe demographics and clinical characteristics and treatment options of EC cases and controls among patients attending the Garissa County Referral Hospital (GCRH) and determine EC-associated factors.

MATERIALS AND METHODS

Study design and setting

This hospital-based case–control study followed a retrospective review of all available records of patients with EC beginning from 1 Januaryry 2019 to 31 January 2022 at GCRH. GCRH is a level 5 county referral hospital with 224 bed capacity in Garissa, which also acts as regional referral for other Kenyan counties such as Mandera, Wajir and Tana River. It has a regional oncology clinic with radiotherapy services. Online supplemental file 1 shows the map of the study site indicating Africa, Kenya and Garissa .

Study size

The sample size was estimated using the proportion of Kenyan adults who smoke (~16%) because tobacco smoking is one of the risk factors for EC.[9] Assuming a proportion of adult smokers to be 16% in Garissa and a two-tailed alpha of 0.05, a sample size of 282 (141 cases and 141 controls) was adequate to detect a minimum OR of 2.25 at 80% power. Data from Garissa County were used to determine the sample size, as the study was conducted at GCRH, which primarily serves the population of Garissa County, with only a small proportion of patients referred from neighbouring counties. Garissa County's population and exposure profile were most representative of the target population. Based on a previous study, an OR of 2.25 indicated the minimum clinically meaningful association for smoking as a risk factor for EC.[10] The present study employed a 1:2 case-to-control ratio, representing 141 cases and 282 controls (a total of 423 cases and controls) to increase the study power (to 90%).

Study population and sampling procedure

The target population included patients seeking medical care at GCRH. Patient records were restropectively reviewed, focusing on individuals whose medical histories were accessible through the GCRH medical records department. Specifically, cases were identified as patients with histologically confirmed EC, aged at least 18 years and diagnosed either at GCRH or other diagnostic facilities. Patients who had other cancer types or those diagnosed with EC at GCRH but transferred for management elsewhere were excluded. Controls were selected from patients without EC admitted to GCRH for unrelated conditions. Controls included patients aged at least 18 years and had no prior history of EC.

Control files were selected using a simple random sampling method from the adult medical and surgical section of the medical records, which exclusively encompasses records from medical and surgical clinics and wards, excluding those from gynaecology, maternity or paediatric departments. This section contained a total of 3000 consecutively (based on admission dates) serialised files. To ensure randomness in selection, an online research randomiser[8] was used to generate 282 unique numbers within the range of 1 to 3000. Subsequently, files were chosen if their serial numbers matched the 282 randomly generated numbers. The file selection process is demonstrated in online supplemental file 2.

Variables of the study

The outcome variable was either a case or a control. The explanatory variables included socio-demographic factors such as age (grouped into five categories: ≤30 years, 31–40, 41–50, 51–60 or >60 years), sex (male or female), county of residence (Garissa or other areas) and risk factors (tobacco use, alcohol use, history of chewing miraa and consumption of hot beverages such as tea and porridge). Clinical characteristics such as dysphagia, odynophagia, chest pain, cough, weight loss and vomiting were also considered. Treatment options were collected only for EC cases to describe management approaches and were categorised as surgery/gastrostomy tube (G-tube), chemo-radiation, chemo-radiation with surgery or palliative care. Variables were selected based on prior literature and clinical relevance to EC. Data on exposures (eg, tobacco use, alcohol, hot beverages and miraa chewing) were abstracted from medical records and categorised based on whether the behaviour was currently or previously documented. Gastro-oesophageal reflux disease (GERD), gastritis and peptic ulcer disease (PUD) were recorded if documented in past diagnoses or discharge notes. Variables were recorded as binary (yes/no) due to the nature of the data available in in-patient files, which reflected responses to routine clinical history-taking. These secondary hospital records did not consistently capture quantitative details such as frequency, duration or intensity of exposures. As such, binary categorisation was the format necessary for analysis. Data for all variables were extracted as reported in the files.

Procedures

The lead researcher (AB) approached the hospital administration for permission to access the facility and patient's records after obtaining ethical permit to conduct the

research. The data extraction tool was developed by the first author and underwent a series of review and amendments by MN and SMK. Data were extracted using the data extraction tool adapted to spreadsheet and entered into a password protected database.

Statistical analysis

Data are reported as categories with frequencies and proportion and compared between cases and controls using Pearson's $\chi 2$ test or Fisher's exact test, when observations were rare. Mixed-effect logistic regression models, with the county of resident as a random intercept, were used to identify EC-associated factors. County was used as a random intercept to account for unobserved inter-county differences in healthcare access and environmental exposures. Bivariable regression models were performed for each independent variable adjusted for age and sex as priori confounders.

For multivariable analysis, variables were selected based on theoretical knowledge, following the disjunctive cause criterion as described by VanderWeele,[11] which recommends adjusting for variables that are causes of the exposure, the outcome or both, to reduce confounding bias. Variables suspected to be causes of exposure included education level and occupation. Variables considered as causes of the outcome included tobacco use, alcohol use, consumption of hot tea, chewing of miraa, GERD, gastritis and PUD. Some variables, such as sex and age, were considered to influence both the exposure and outcome and were included in the final model. Statistical significance was set at $p<0.05$. All statistical analysis was performed using STATA version 15 (StataCorp LP, College Station, TX, USA).[12]

Patient and public involvement

The public were actively engaged in the dissemination plans of this research. Feedback sessions were held with the Garissa County Department of Health to review the findings and discuss their implications. These discussions were instrumental in contextualising the results and aligning them with the community's public health priorities, ensuring a collaborative and actionable approach to addressing the study's outcomes.

Ethical consideration

The study was approved by Pwani University Ethics and Review Committee (ERC/Msc/041/2021), and permission to collect data was granted by the administration of GCRH. Only anonymised data were extracted from patient files. Privacy and confidentiality of the patient data were maintained by ensuring that the data were only accessible to the investigators.

RESULTS

A total of 423 participants were included in the study, comprising 141 EC cases and 282 controls. Among the 141 cases, 50 (36%) were aged >60 years compared with 71 (25%) of the 282 controls, indicating a greater burden of EC among older individuals. 134 (95%) cases and 252 (89%) controls had formal education. Sex distribution differed significantly (p=0.027), with males accounting for 73 (52%) of the cases compared with 122 (43%) of the controls, whereas females made up 68 (48%) of cases and 160 (57%) of controls. Overall, compared with other counties, most participants were from Garissa County, that is, 282 (67%) vs 141 (33%) for other counties; this distribution was similar for cases and controls (table 1).

Table 1 Demographic characteristics of patients with oesophageal cancer

Demographic factors N (%).		Oesophageal cancer status			
		Total n=423	Controls n=282	Cases n=141	P value
Age (years)	≤30	53 (13)	49 (17)	4 (3)	**<0.001**
	31–40	78 (18)	60 (21)	18 (13)	
	41–50	76 (18)	52 (18)	24 (17)	
	51–60	95 (23)	50 (18)	45 (32)	
	>60	121 (28)	71 (25)	50 (36)	
Sex	Female	228 (54)	160 (57)	68 (48)	**0.027**
	Male	195 (46)	122 (43)	73 (52)	
Education level	Informal	386 (91)	252(89)	134 (95)	0.052
	Some formal education	37 (9)	30 (11)	7 (5)	
Employment	None	264 (62)	173 (61)	91 (65)	0.523
	Some	159 (38)	109(39)	50 (35)	
Residence	Garissa	282 (67)	201(71)	98 (70)	0.735
	Others	141 (33)	81 (29)	43 (30)	

P-values are from $\chi 2$ or Fisher's exact test. Significant p-values are presented in BOLD.

Table 2 Clinical characteristics of the cases

Clinical characteristics		Cases N (%)
Site	Lower third (distal)	72 (51)
	Middle third (medial)	59 (42)
	Upper third (proximal)	10 (7)
Dysphagia	No	6 (4)
	Yes	135 (96)
Odynophagia	No	126 (89)
	Yes	15 (11)
Chest pain	No	132 (94)
	Yes	9 (6)
Cough	No	104 (74)
	Yes	37 (26)
Weight loss	No	86 (60)
	Yes	55 (40)
Vomiting	No	102 (72)
	Yes	39 (28)

Clinical characteristics of the cases

Of the 141 patients with EC, 72 (51%) had cancer in the lower third (distal) of the oesophagus, whereas 59 (42%) and 10 (7%) had cancers in the middle (medial) and upper third (proximal) of the oesophagus, respectively (table 2). Dysphagia was a common symptom, with 135 (96%) of the cases presenting with dysphagia. 15 (11%) patients had odynophagia, whereas 9 (6%) had chest pains. 37 (26%) patients had cough, whereas 55 (40%) and 39 (28%) had weight loss and vomiting, respectively (table 2)

Exposure characteristics of the participants

Several risk factors differed significantly between cases and controls across several factors (table 3). Tobacco use was reported by 15 (11%) of 141 cases but only 4 (1.4%) of 282 controls (p<0.001). Similarly, smoking was reported by 15 (11%) of cases vs 14 (5%) of controls, and a significantly higher proportion of cases had a family history of EC (p<0.001), hot tea consumption (p=0.002), chewing miraa (p=0.001), GERD (p<0.001) and PUD(p<0.001). Other factors such as obesity, alcohol use and gastritis did not show significant differences between cases

Table 3 Exposure characteristics of the participants

Risk factors*. N (%)		Oesophageal cancer status			
		Total n=423	Controls n=282	Cases n=141	P value
Tobacco use	No	404 (96)	278 (99)	126 (89)	**<0.001**
	Yes	19 (4.5)	4 (1.4)	15 (11)	
Smoking	No	394 (93)	268 (95)	126 (89)	**0.029**
	Yes	29 (7)	14 (5)	15 (11)	
Obesity/overweight	No	422 (99.8)	282 (10)	140 (99)	0.333
	Yes	1 (0.2)	0 (0)	1 (1)	
Family history	No	408 (97)	282 (100)	126 (89)	**<0.001**
	No-EC	5 (1)	0 (0)	5 (4)	
	EC	10(2)	0 (0)	10(7)	
Hot tea consumption	No	414(98)	281(99)	133(95)	**0.002**
	Yes	8 (2)	1 (1)	7 (5)	
Chew miraa	No	391(92)	269(95)	122(87)	**0.001**
	Yes	32(8)	13(5)	19(13)	
Alcohol use	No	415(98)	277(98)	138(99)	1.000
	Yes	7 (2)	5 (2)	2 (1)	
GERD	No	344(81)	270(96)	74(52)	**<0.001**
	Yes	79(19)	12(4)	67(48)	
Gastritis	No	413(98)	279(99)	134(96)	0.065
	Yes	9 (2)	3 (1)	6 (4)	
PUD	No	403(95)	280(99)	123(87)	**<0.001**
	Yes	20(5)	2 (1)	18(13)	

P-values are from $\chi 2$ or Fisher's exact test. Significant p-values are presented in BOLD.
*'Yes' indicates documented presence of exposure or condition. 'No' indicates absence or not recorded.
GERD, gastro-oesophageal reflux disease; PUD, peptic ulcer disease.

Table 4 Regression analysis of factors associated with oesophageal cancer

Factors		Bivariable analysis OR OR (95% CI)	P value	Multivariable analysis Adjusted OR (95% CI)	P Value
Age	≤30 years	*		1 (reference)	.
	31–40	*		2.5 (0.58 to 10.73)	0.219
	41–50	*		2.79 (0.7 to 11.13)	0.147
	51–60	*		2.04 (0.5 to 8.37)	0.321
	>60 years	*		4.03 (1.05 to 15.5)	**0.042**
Sex	Female	*		1(reference)	.
	Male	*		1.21 (0.58 to 2.51)	0.608
Education level	None	1 (reference)	.	1 (reference)	.
	Some education	0.49 (0.19 to 1.27)	0.143	0.37 (0.09 to 1.48)	0.16
Occupation	Unemployed	1 (reference)	.	1 (reference)	.
	Some employment	0.82 (0.51 to 1.32)	0.41	0.71 (0.35 to 1.47)	0.36
Tobacco use	No	1 (reference)	.	1 (reference)	.
	Yes	6.26 (1.96 to 19.97)	**0.002**	21.02 (5.41 to 81.69)	**<0.001**
Smoking	No	1 (reference)	.	1 (reference)	.
	Yes	1.67 (0.73 to 3.81)	0.221	2.66 (0.81 to 8.76)	0.107
Hot tea consumption	No	1 (reference)	.	1 (reference)	.
	Yes	13.24 (1.59 to 110.42)	**0.017**	59.87 (5.45 to 657.35)	**0.001**
Chewing miraa	No	1 (reference)	.	1 (reference)	.
	Yes	3.07 (1.35 to 7)	**0.007**	9.94 (3.59 to 27.52)	**<0.001**
Alcohol use	No	1 (reference)	.	1 (reference)	.
	Yes	0.66 (0.12 to 3.66)	0.631	0.4 (0.05 to 3.08)	0.376
GERD history	No	1 (reference)	.	1 (reference)	.
	Yes	20.07 (10 to 40.27)	**<0.001**	54.12 (24.48 to 119.62)	**<0.001**
Gastritis history	No	1 (reference)	.	1 (reference)	.
	Yes	4.51 (1.01 to 20.17)	**0.049**	17.89 (2.94 to 108.98)	**0.002**
PUD history	No	1 (reference)	.	1 (reference)	.
	Yes	17.53 (3.93 to 78.16)	**<0.001**	69.31 (14.09 to 340.9)	**<0.001**

ORs are from multilevel mixed-effect logistic regression. Significant p-values are presented in BOLD.
*Variable adjusted for as priori confounders.
GERD, gastroesophageal reflux disease; PUD, peptic ulcer disease.

and controls, with p-values of 0.333, 1.000 and 0.065, respectively.

Factors associated with oesophageal cancer

In the bivariable analysis, tobacco use (OR 6.26, 95% CI 1.96 to 19.97 ; p<0.002), hot tea consumption (OR 13.24, 95% CI 1.59 to 110.42; p=0.017), chewing miraa (OR 3.07, 95% CI 1.35 to 7; p<0.007), GERD (OR 20.07, 95% CI 10 to 40.27; p<0.001), gastritis (OR 4.51, 95% CI 1.01 to 20.17; p=0.049) and PUD (OR 17.53, 95% CI 3.93 to 78.16; p<0.001) were associated with EC (table 4).

In the multivariable analysis (table 4), age >60 years (adjusted OR (AOR) 4.03, 95% CI 1.05 to 15.5; p=0.042), tobacco use (AOR 21.02, 95% CI 5.41 to 81.69; p=0.042), hot tea consumption (AOR 59.87, 95% CI 5.45 to 657.35; p=0.001), chewing miraa (AOR 9.94, 95% CI 3.59–27.52; p<0.001), GERD (AOR 54.12, 95% CI 24.48 to 119.62; p<0.001), gastritis (AOR 17.89, 95% CI 2.94 to 108.98; p=0.002) and PUD (AOR 69.31, 95% CI 14.09–340.9; p<0.001) were associated with EC.

Treatment option for EC

Most participants (n=92, 65%) had surgery or G-tube placement as treatments for EC. Combined chemo-radiation and surgery accounted for 8 (6%) of the treatment options, whereas chemo-radiation alone accounted for 33 (23%). About 8 (6%) participants were receiving palliative treatment (table 5).

DISCUSSION

This hospital-based case–control study aimed at describing features of EC cases, its associated factors and treatment services available. The study revealed several characteristics of EC, including a predilection for individuals aged >60 years. Previous studies have reported

a similar disproportionate burden of EC among older adults.[9 10] In their examination of global trends in EC, Wang and colleagues documented a rising incidence rate of EC from early adulthood, peaking at age 60–64 years and then declining afterwards.[13] The high burden of EC in older patients may have several plausible explanations. First, the physiological changes associated with ageing are complex and may potentially contribute to the pathogenesis of EC.[11] Genetic–environment interactions may also accelerate the risk of EC with age. For instance, smoking cigarettes not only increases the risk of EC[12] but also exacerbates the ageing process.[14] Age can serve as a proxy for both the cumulative exposure to cancer risk and the duration during which that risk persists (indicative of enduring predisposition to carcinogens). The variation in EC cases by age distributions in different settings may be due to differences in exposure to risk factors, environmental factors and uneven accessibility to healthcare services.

In addition to older age, EC was also more common in males than in females. This finding confirms those reported previously where EC had a male-to-female incidence rate ratio of 3:1 for oesophageal squamous cell carcinoma and 7:1 for oesophageal adenocarcinoma.[13] This male predominance has been particularly strong in developed countries[15] but is now increasingly being observed in developing countries, including in the present study. The burden of oesophageal squamous cell carcinoma in men is largely attributed to smoking and heavy alcohol consumption and khat.[16]

Clinically, in this study, EC cases frequently presented with symptoms such as dysphagia, odynophagia, chest pain, cough, weight loss and vomiting, underlining the varied clinical presentation of this disease. These findings have been reported in other settings[17–19] and provide insights into the clinical profile of EC. However, most serious symptoms appear in later stages of diseases. Therefore, established risk factors serving as proxies for biomarkers can be helpful in early diagnosis and treatment. The study also showed that EC primarily manifested in the lower and middle thirds of the oesophagus. This finding concurs with a Tanzanian study that demonstrated that the middle third part of the oesophagus is the most frequent anatomical site for EC, followed by the lower and upper thirds.[20] This could be attributed to their proximity to noxious stimuli from gastric acid contents. Understanding the predominant anatomical distribution of EC is crucial for optimising lesion detection and biopsy site selection. By focusing on the lower and middle thirds of the oesophagus, where EC primarily manifests, endoscopists can enhance sensitivity and diagnostic yield, saving resources for the patients.

Consistent with the results of previous studies, this study identified tobacco use, smoking, hot tea consumption, chewing miraa, GERD history, history of gastritis history and PUD as significant risk factors for EC.[21 22] In a study study conducted within an EC endemic region in western Kenya, a positive association was identified between the consumption of hot beverages and the heightened EC risk.[23] Tobacco use and smoking are well-known to be risk factors for EC because tobacco smoke contains cancer-causing compounds, such as polycyclic aromatic hydrocarbons, N-nitrosamines, aromatic amines, acetaldehyde and isoprene.[24] Similarly, habitual drinking of hot tea may subject the oesophageal lining to repeated thermal injury, potentially creating conditions that promote cancer growth.[25] Miraa, commonly consumed in north-eastern Kenya, contains cathinone and other compounds that may be mutagenic and carcinogenic.[26] Targeted awareness campaigns should be developed and implemented in the region to reduce the consumption of miraa and mitigate its links to EC. The significance of GERD, gastritis and PUD as risk factors for EC suggests that chronic inflammation and cellular damage that are associated with exposure to harmful contents from these conditions may be precursors to EC development.[10] These findings demonstrate the multifactorial risk of EC and highlight the need for further research into the complex relationships between lifestyle factors, environmental influences and underlying biological mechanisms that contribute to EC, such as genetic susceptibility. These findings further emphasise the importance of lifestyle modifications and the management of gastrointestinal conditions in mitigating EC risk.

Regarding treatment patterns, surgical intervention or G-tube placement was the primary treatment option for EC, followed by combined chemo-radiation and surgery. Additionally, a significant proportion of patients underwent chemo-radiation alone. This finding demonstrates recent evolution in EC therapy. Endoscopic resection and ablation therapy are effective and commonly used for early-stage tumours[27] but were not common in our evaluation because of the late presentation of patients with EC to hospitals. Radiation, such as X-rays, effectively targets cancer cells and is often paired with chemotherapy or immunotherapy for synergistic effects, especially for patients unsuitable for surgery.[28 29]

Table 5 Treatment offered to cases (n=141)

Treatment options	Cases N (%)
Palliative	8 (5.6)
Surgery/G-tube	92 (65)
Chemo-radiation	33 (23)
Chemo-radiation and surgery	8 (5.6)

Palliative=non-curative care; surgery/G-tube=surgical resection or gastrostomy. Chemo-radiation=chemotherapy and/or radiation therapy.
G-tube, gastrostomy tube.

Strengths and limitations

A key strength of the study was the histological confirmation of EC cases, which ensured diagnostic accuracy and minimised the risk of misclassification bias in identifying true cases of EC. Additionally, the researchers

systematically reviewed and reported EC case data that had not previously been documented in this setting, contributing novel insights to the understanding of EC. The study relied on patient-reported exposures, which are subject to recall bias and limited only to routine data collected. The case–control study design cannot establish time sequence between exposure and being a case. Additionally, the study was conducted in a Garissa referral facility, the proximity to the hospital could have affected the cases seen, and being a regional hospital, it would attend to most of the cases from the region. Many other patients with EC may have been seen elsewhere or even died before referral (including their peripheral facilities), with only serious cases being referred to GCRH, depending on their health-seeking behaviour. Data on the temperature of tea, duration and frequency of smoking were not available from patient records, limiting dose-response analysis. Many of these variables were reported by the patients hence subject to reporting bias.[1] The use of a 3 year retrospective window may have limited the ability to capture long-term exposure patterns or changes in risk factor prevalence over time. Lastly, histological subtypes (e.g., squamous vs adenocarcinoma) were not uniformly documented and could not be analysed separately.

Conclusion

Taken together, the findings contribute to understanding EC by highlighting its disproportionate burden among older adults and male patients. The varied clinical presentation emphasises the importance of investment in early detection and management. EC predominantly affects the lower and middle thirds of the oesophagus, which should be targeted for diagnostic endoscopy, to save on resources. Risk factors such as tobacco use, smoking, hot tea consumption and gastrointestinal conditions can be targeted through simple public health interventions to reduce the incidence of EC. Healthcare providers should emphasise lifestyle modifications, including smoking cessation and moderation of hot beverage consumption, to mitigate EC risk. Longitudinal studies could establish the temporal relationships and interactions between risk factors and EC development, and prospective trials could evaluate the efficacy of novel treatment modalities, such as immunotherapy, in improving patient outcomes, and behavioural modification interventions, in preventing EC. Furthermore, research focusing on the molecular mechanisms underlying EC pathogenesis may uncover potential biomarkers for early detection and targeted therapies, ultimately advancing personalised medicine approaches in EC management.

Transparency

BO affirms that this manuscript is an honest, accurate and transparent account of the study being reported. All significant aspects of the study have been included, and any deviations from the registered protocol have been thoroughly explained.

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Acknowledgements We give special thanks to patients attending GCRH whose data were used in this study. We acknowledge all individuals who contributed to the preparation and writing of this paper, recognising them as contributing authors.

Contributors The study protocol was designed by AB, MN and SMK. Data extraction was performed by AB. BO and OA conducted the statistical analysis. AB and BO authored the manuscript with input from MN, SMK, OA and MY. All authors reviewed and approved the final manuscript. BO is the guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval The study received ethical approval from the Pwani University Ethics and Review Committee (ERC/Msc/041/2021).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Data supporting the findings of this study are available upon reasonable request from the corresponding author.

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