Global esophageal cancer epidemiology in 2022 and predictions for 2050: A comprehensive analysis and projections based on GLOBOCAN data

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Abstract

Background: The burden of esophageal cancer varies across different regions of the world. The aim of this study is to analyze the current burden of esophageal cancer in 185 countries in 2022 and to project the trends up to the year 2050.

Methods: We extracted data on primary esophageal cancer cases and deaths from the GLOBOCAN 2022 database, which includes data from 185 countries. Age-standardized incidence rates (ASIR) and mortality rates (ASMR) per 100,000 person-years were calculated by stratifying by Human Development Index (HDI) levels and regions. Considering changes in population size and age structure, we assumed that the risks of incidence and mortality remain constant at the levels of 2022 to forecast the number of new cases and deaths from esophageal cancer globally by 2050.

Results: In 2022, an estimated 511,054 people were diagnosed with esophageal cancer globally, and 445,391 died from the disease. The global ASIR and ASMR for esophageal cancer were 5.00 and 4.30 per 100,000, respectively. The highest rates were observed in East Africa (7.60 for incidence, 7.20 for mortality per 100,000), East Asia (7.60 for incidence, 5.90 for mortality per 100,000), Southern Africa (6.30 for incidence, 5.90 for mortality per 100,000), and South Central Asia (5.80 for incidence, 5.50 for mortality per 100,000). Among the 185 countries worldwide, esophageal cancer was among the top five causes of cancer incidence in 18 countries and among the top five causes of cancer mortality in 25 countries. In 2022, China had 224,012 new cases and 187,467 deaths from esophageal cancer, accounting for approximately 43.8% and 42.1% of the global total, respectively, which is higher than the proportion of China's population to the global population (17.9%). ASIR was 8.30 per 100,000, and ASMR was 6.70 per 100,000. The highest burden of esophageal cancer was in high HDI countries, with new cases and deaths accounting for 51.3% and 50.0% of the global total, respectively. The ASIR and ASMR were highest in the high HDI group (6.10 and 5.10 per 100,000, respectively), also exceeding the global averages. There was a trend of decreasing mortality to incidence ratio with increasing HDI, but no correlation was observed between HDI and ASIR or ASMR. In all regions worldwide, the incidence and mortality rates were higher in males than in females (with a male-to-female ASR ratio ranging from 1.10 to 28.7). Compared to 2022, it is projected that by 2050, the number of new esophageal cancer cases will increase by approximately 80.5%, and deaths will increase by 85.4% due to population growth and aging.

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Conclusions: The burden of esophageal cancer remains heavy. Adopting a healthy lifestyle, including reducing tobacco and alcohol intake, avoiding moldy foods, and increasing intake of fresh fruits and vegetables, can help reduce the risk of stomach and esophageal cancer. In addition, the development and implementation of evidence-based and effective public health policies are critical to reducing the global disease burden of esophageal cancer.
Keywords: Esophageal cancer; Incidence; Mortality; Projection; Disease burden

Introduction

Esophageal cancer is the eleventh most commonly diagnosed cancer and the seventh leading cause of cancer-related deaths globally.[1] The burden of this malignant tumor is disproportionately high in less developed regions, accounting for approximately 80% of all cases in these areas, with about 70% of cases occurring in males. There is a roughly threefold difference in incidence and mortality rates between the sexes. Additionally, the risk of developing esophageal cancer increases with age, showing a higher prevalence among the elderly population. With the growth and aging of the global population, as well as the continued presence of associated risk factors, the cancer burden of esophageal cancer is expected to progressively increase. Moreover, due to its high degree of malignancy, esophageal cancer often has a poor prognosis. In most countries, the 5-year survival rate after diagnosis is quite low, ranging from about 10% to 30%.[2] The burden of esophageal cancer varies significantly among different countries and populations, which is related to the underlying risk factors for prevalence and the differences in the distribution of subtypes.[3–8]

In this article, we have collected and analyzed the global burden of esophageal cancer incidence and mortality rates from the GLOBOCAN 2022 database published by the International Agency for Research on Cancer (IARC). We described and compared the geographical disparities in the incidence and mortality rates of esophageal cancer across different countries and regions. We assessed the association between the Human Development Index (HDI) levels (low, medium, high, and very high, based on the United Nations Development Programme's 2022 Human Development Report) and the incidence and mortality rates of esophageal cancer. We also provided projections for the global burden of esophageal cancer up to the year 2050. Monitoring and understanding the current and future epidemiology of esophageal cancer will be beneficial for the development of effective and timely prevention or treatment strategies.

Methods

Data colletion and analyses

The data for this study were derived from the GLOBOCAN 2022 database published by the IARC. The database's statistics are categorized based on the International Classification of Diseases, 10th Revision (ICD-10) coding system. For this study, all data corresponding to the ICD-10 code Cancer Incidence in Five Continents (CI5) for esophageal cancer were extracted. Age groups were defined in 5-year increments, creating a total of 18 groups ranging from 0–4 years to 80–84 years, and 85 years and older.

These data were taken from two platforms: CANCER TODAY (https://gco.iarc.fr/today) and CANCER TOMORROW (https://gco.iarc.fr/tomorrow). CANCER TODAY covers a range of information on the incidence and associated mortality of 36 different cancer types in different countries or regions around the world and provides data visualization tools designed to help researchers delve deeper into the global cancer burden in 2022. CANCER TOMORROW projected the global cancer burden through 2050. The estimated age-standardized incidence rate (ASIR) or age-standardized mortality rate (ASMR) for the baseline year of 2022 multiplied by the corresponding expected population size for a given year is the projected number of new cancer cases and associated deaths for a given year.

Geographical regions were classified according to the United Nations' regional divisions, with Micronesia and Polynesia being combined due to considerations of population coverage and the volume of incidence data, resulting in a total of 20 categories. Additionally, in light of the burden of esophageal cancer in China, a separate presentation and comparison were made for China in the regional classification.

The HDI groups were categorized based on the HDI data published by the United Nations, and were divided into very high HDI, high HDI, medium HDI, and low HDI. The calculation of the sex ratio was based on the age-standardized rate (ASR), using Segi's world standard population as the reference. Data management and analysis were conducted using SAS software, version 9.4 (https://www.sas.com).

Results

Global burden of esophageal cancer incidence and mortality

In 2022, it is estimated that 511,054 individuals were diagnosed with esophageal cancer globally, and 445,391 died from the disease. The overall age-standardized incidence rate (ASIR) for new cases of esophageal cancer was 5.00 per 100,000, with significant disparities in ASIR across different regions of the world. The regions with the highest ASIR (East Africa: 7.60 per 100,000 and East Asia: 7.60 per 100,000) had approximately 7.8 times of the region with the lowest rate (Central America: 0.97 per 100,000). The overall ASMR for esophageal cancer mortality was 4.30 per 100,000, with large variations in ASMR across regions. The region with the highest ASMR (East Africa: 7.20 per 100,000) had mortality rate approximately 8.4 times than that of the region with the lowest ASMR (Central America: 0.86 per 100,000). The regions of East Africa (ASIR = 7.60 per 100,000, ASMR = 7.20 per 100,000), Southern Africa (ASIR = 6.30 per 100,000,

ASMR = 5.90 per 100,000), East Asia (ASIR = 7.60 per 100,000, ASMR = 5.90 per 100,000), and South Central Asia (ASIR = 5.80 per 100,000, ASMR = 5.50 per 100,000) had significantly higher incidence and mortality rates than the global average (ASIR = 5.00 per 100,000, ASMR = 4.30 per 100,000). In 2022, the population of East Asia constituted 20.5% of the world's population, and the number of new and death cases of esophageal cancer in the East Asia region accounted for nearly half of the global total (48.6% and 45.6%, respectively). Of these, China alone accounted for 43.8% of the new cases and 42.1% of the deaths from esophageal cancer worldwide. It is estimated that in 2022, there were 224,012 new cases and 187,467 deaths from esophageal cancer in China, with both the new and death cases of esophageal cancer accounting for a higher proportion of the global total than the proportion of China's population to the total world population (17.9%) [Table 1 and Figure 1].

When comparing HDI groups, high HDI countries had the highest ASIR and ASMR (6.10 per 100,000 for incidence, 5.10 per 100,000 for mortality), which exceeded the global average. Furthermore, the new cases and deaths in the high HDI group accounted for 51.3% and 50.0% of the global total, respectively. The very high HDI countries had the lowest ASIR and ASMR (3.10 per 100,000 for incidence, 2.50 per 100,000 for mortality). However, there was no significant difference in ASRs between the high HDI group and other groups, with rates ranging between 2.50 and 6.10 per 100,000. No correlation was observed between a country's HDI and the ASIR or ASMR. However, a decreasing trend was observed between the mortality to incidence ratio (ASMR: ASIR/mortality-crude rate: incidence-crude rate, M:I) as the HDI increased [Table 1 and Supplementary Figures 1–4, http://links.lww.com/CM9/C253].

The five countries with the highest ASIR and ASMR were Malawi (17.90 per 100,000, 17.00 per 100,000), Bangladesh (16.00 per 100,000, 15.30 per 100,000), Mongolia (15.70 per 100,000, 14.40 per 100,000), Uganda (13.20 per 100,000, 12.80 per 100,000), and Kenya (13.00 per 100,000, 12.40 per 100,000); and the five countries with the lowest ASIR and ASMR were Maldives (0, 0), Sierra Leone (0.01 per 100,000, 0.01 per 100,000), Timor-Leste (0.22 per 100,000, 0.22 per 100,000), Vanuatu (0.42 per 100,000, 0.42 per 100,000), and Republic of Congo (0.43 per 100,000, 0.38 per 100,000) [Supplementary Table 1, http://links.lww.com/CM9/C253].

Sex disparities in esophageal cancer incidence and mortality rates

Sex disparities were also evident in all regions of the world, and ASIR and ASMR were higher in males than in females in all regions. The three regions with the highest

Table 1: Estimated number of primary esophageal cancer cases and deaths, and age-standardized incidence and mortality rates per 100,000 persons in 2022, by world region and HDI.

	Population		Incidence					Mortality				
Regions	Total	Percentage of world total (%)	Number of cases	Percentage of world total (%)	Crude rate (per 100,000)	ASR	M:F	Number of cases	Percentage of world total (%)	Crude rate (per 100,000)	ASR	M:F
World	7,885,070,781	100.00	511,054	100.0	6.50	5.00	2.9	445,391	100.0	5.60	4.30	3.0
HDI												
Very high HDI	1,641,517,866	20.80	107,524	21.00	6.60	3.10	4.1	88,639	19.90	5.40	2.50	4.5
High HDI	2,759,611,561	35.00	261,867	51.30	9.50	6.10	3.5	222,730	50.00	8.10	5.10	3.7
Medium HDI	2,269,659,554	28.80	112,931	22.10	5.00	5.30	1.9	106,923	24.00	4.70	5.00	2.0
Low HDI	1,210,899,293	15.40	28,588	5.60	2.40	4.30	1.3	26,967	6.10	2.20	4.10	1.3
China	1,411,750,006	17.90	224,012	43.80	15.90	8.30	3.4	187,467	42.10	13.30	6.70	3.7
Eastern Africa	468,849,237	5.90	17,936	3.50	3.80	7.60	1.4	16,933	3.80	3.60	7.20	1.5
Middle Africa	190,463,603	2.40	2617	0.50	1.30	2.70	2.0	2480	0.60	1.20	2.60	1.9
Northern Africa	254,985,181	3.20	3231	0.60	1.30	1.40	1.3	3126	0.70	1.20	1.40	1.3
Southern Africa	69,191,678	0.90	3621	0.70	5.20	6.30	1.8	3321	0.70	4.80	5.90	2.0
Western Africa	423,239,061	5.40	2560	0.50	0.59	1.20	1.2	2416	0.50	0.55	1.20	1.2
Caribbean	44,017,287	0.60	1758	0.30	4.00	2.80	3.5	1625	0.40	3.70	2.60	3.8
Central America	183,739,076	2.30	1959	0.40	1.10	0.97	3.5	1755	0.40	0.96	0.86	3.6
South America	437,694,436	5.60	16,649	3.30	3.80	2.80	4.4	15,515	3.50	3.50	2.60	4.5
Northern America	373,318,358	4.70	21,888	4.30	5.90	2.90	4.0	19,116	4.30	5.10	2.40	4.9
Eastern Asia	1,618,033,503	20.50	248,384	48.60	15.40	7.60	3.6	203,035	45.60	12.6	5.90	3.8
South-Eastern Asia	681,491,532	8.60	15,108	3.00	2.20	2.00	4.9	14,334	3.20	2.10	1.90	4.8
South-Central Asia	2,060,388,839	26.10	114,956	22.50	5.60	5.80	1.7	108,482	24.40	5.30	5.50	1.7
Western Asia	288,359,967	3.70	4444	0.90	1.50	1.70	1.1	3952	0.90	1.50	1.50	1.3
Eastern Europe	291,862,973	3.70	17,102	3.30	5.90	3.20	6.4	15,551	3.50	5.3	2.80	6.7
Northern Europe	107,127,639	1.40	12,646	2.50	11.80	5.00	2.9	11,255	2.50	10.50	4.10	3.0
Southern Europe	151,644,503	1.90	6440	1.30	4.30	1.80	4.7	5605	1.30	3.70	1.50	5.0
Western Europe	196,908,712	2.50	17,325	3.40	8.80	3.80	3.6	14,801	3.30	7.50	2.90	4.1
Australia/New Zealand	30,966,994	0.40	2151	0.40	7.00	3.30	3.2	1828	0.40	5.90	2.70	3.9
Melanesia	11,535,551	0.10	249	0.05	2.20	3.30	1.9	233	0.10	2.00	3.10	1.8
Micronesia/Polynesia	1,252,651	0.02	30	0.01	2.40	2.20	28.7	28	0.01	2.20	2.00	26.7

ASR: Age-standardized rate per 100,000; HDI: Human Development Index; M:F: Male:female ratio of ASR.

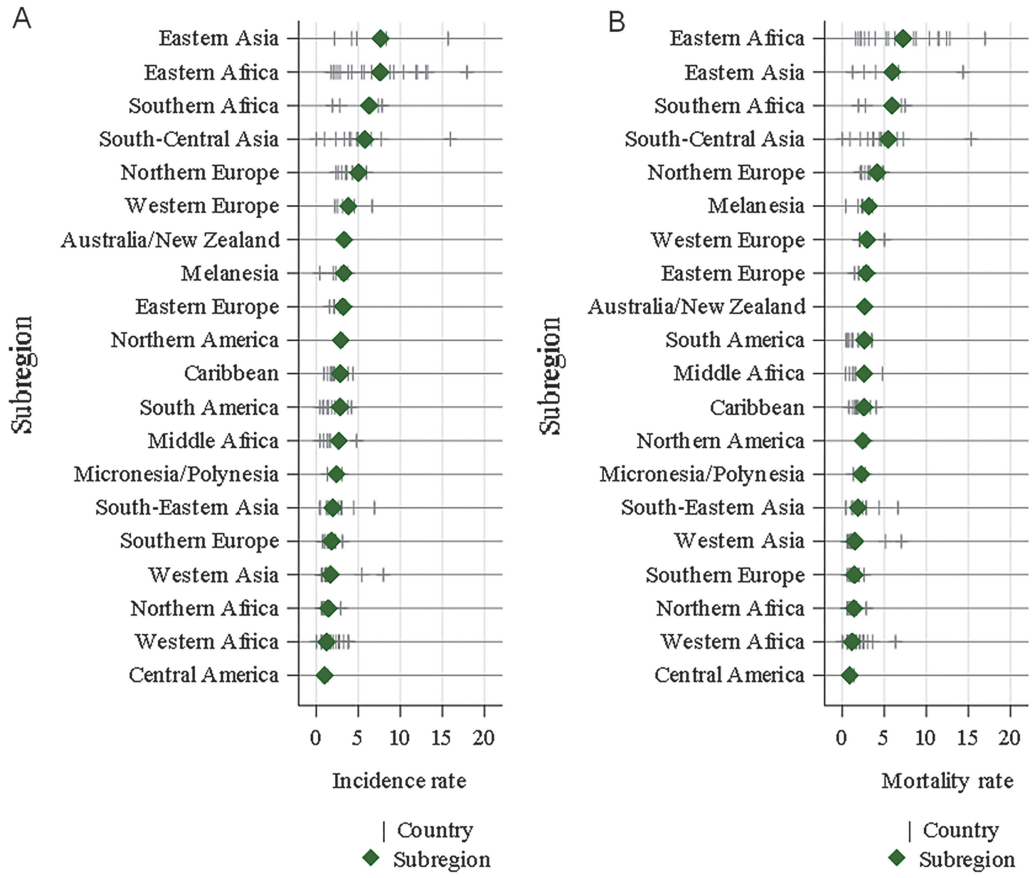

Figure 1: ASRs for primary esophageal cancer per 100,000 people in 2022, by regions. (A) ASIR. (B) ASMR. ASIR: Age-standardized incidence rate; ASMR: Age-standardized mortality rate; ASR: Age-standardized rate.

male-to-female (M:F) ratio for AISR are Micronesia/Polynesia (M:F = 28.7), Eastern Europe (M:F = 6.4), and Southeast Asia (M:F = 4.9); for ASMR, the three regions with the highest M:F ratio are Micronesia and Polynesia (M:F = 26.7), Eastern Europe (M:F = 6.7), and Southern Europe (M:F = 5.0). The regions with the lowest M:F ratio for both ASIR and ASMR are Western Asia (incidence M:F = 1.1, mortality M:F = 1.3), Western Africa (incidence M:F = 1.2, mortality M:F = 1.2), and Northern Africa (incidence M:F = 1.3, mortality M:F = 1.3). The highest difference in the M:F ratio for incidence across regions is 26 times, and for mortality, it is 22 times. (It should be noted that the number of cases and deaths in the Micronesia/Polynesia region are only 30 and 28, respectively, which may result in a significant margin of error.) [Table 1 and Figure 2]. East Asia, East Africa, and Southern Africa are the regions with the highest ASIR and ASMR in males; East Africa, Southern Africa, and South Central Asia are the regions with the highest ASIR and ASMR in females [Table 1 and Supplementary Figures 5 and 6, http://links.lww.com/CM9/C253].

Among 185 countries worldwide, only 8 countries have female ASIR and ASMR higher than male (Qatar, Chad, Ghana, Ethiopia, Yemen, Eritrea, Mozambique, and Somalia). The sex disparities across different countries show that in 9 countries, the male ASIR and ASMR are more than 10 times that of females. In Moldova, the male incidence and mortality rates are more than 20 times that of females (incidence M:F = 21.7, mortality M:F = 22.7). In China, the ASIR for all-sex esophageal cancer was 8.30 per 100,000 and the ASMR was 6.70 per 100,000. The ASIR for males is 13.10 per 100,000 and the ASMR is 10.70 per 100,000, while for females, the ASIR is 3.8 per 100,000 and the ASMR is 2.90 per 100,000, making the male rates 3.5 times and 3.7 times that of females, respectively [Supplementary Tables 1–3, http://links.lww.com/CM9/C253].

Age distribution of esophageal cancer incidence and mortality rates

The age distribution of the ASIR and ASMR for esophageal cancer shows significant variation across the world and its regions, with a common characteristic–both ASIR and ASMR gradually increase with age. Globally, the ASIR and ASMR among those aged 0–49 years (ASIR: 0.69 per 100,000, ASMR: 0.60 per 100,000), 50–64 years (ASIR: 14.36 per 100,000, ASMR: 11.71 per 100,000), and those aged 65 years and above (ASIR: 36.50 per 100,000, ASMR: 32.19 per 100,000) are markedly different. Notably, the East Asia region has the highest ASIR and ASMR in those aged 65 years and above (ASIR: 65.95 per 100,000, ASMR: 56.19 per 100,000), and the

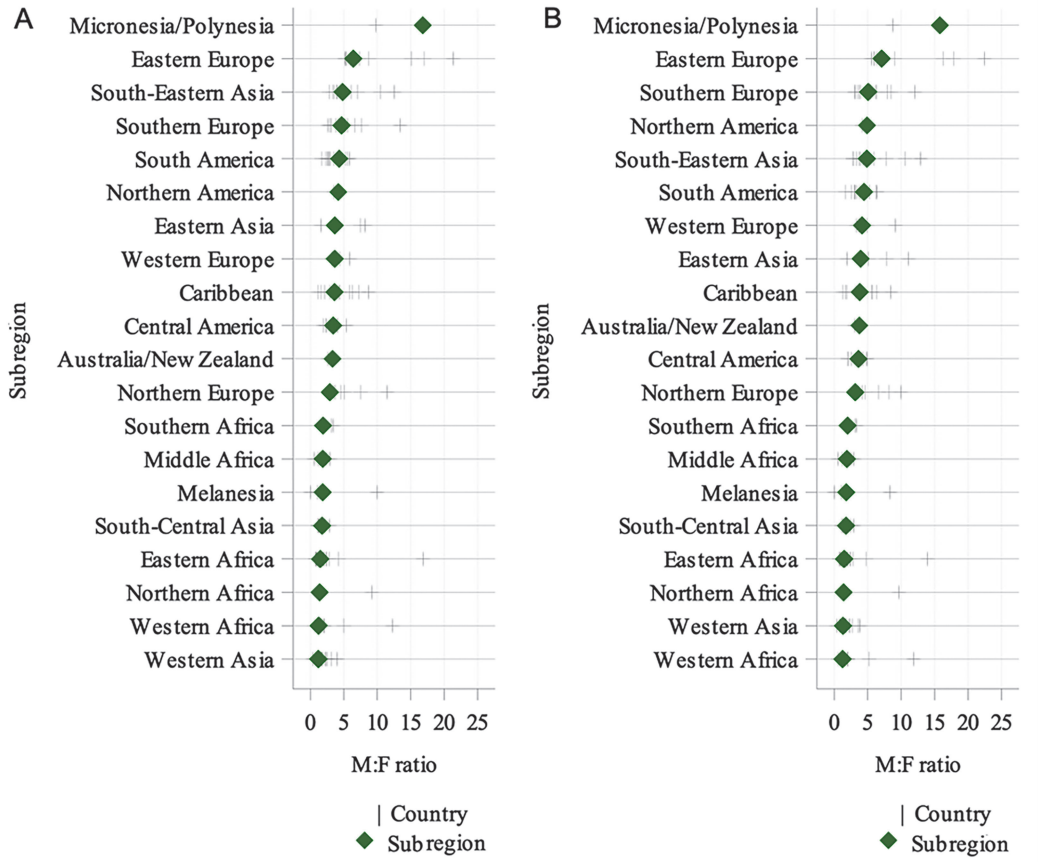

Figure 2: M:F ratio for primary esophageal cancer per 100,000 people in 2022, by regions. (A) M:F ratio of incidence. (B) M:F ratio of mortality; M:F: Male:female.

age differences in this region are the most pronounced, with the ASRs for those aged 65 years and above being approximately 157 times and 225 times that of those under 50 years old, respectively [Supplementary Tables 4 and 5, http://links.lww.com/CM9/C253].

Similarly, at the HDI level, there is a characteristic increase in ASRs with age. The incidence and mortality rates are relatively low in the 0–34 years of age group. Starting from the age of 35 years to 39 years, the rates begin to rise gradually, with medium HDI countries experiencing a sharp increase, and the incidence and mortality rates in the 0–64 years of age group are higher than the global average and the other three levels of HDI. However, in the age group of 65 years and above, high HDI countries have the highest incidence and mortality rates (ASIR: 53.05 per 100,000, ASMR: 47.54 per 100,000). Across all age groups from 0 years to ≥85 years, the heaviest burden of esophageal cancer remains in high HDI countries. The incidence and mortality rates in males change with age, which is basically consistent with the overall trend, but the incidence and mortality rates in females from medium and low HDI countries are somewhat higher than the overall level and above the global average. In 2022, in China, the incidence and mortality rates of esophageal cancer in both sexs, males, and females all began to rise significantly from the age of 45 years, with the cumulative incidence and mortality risks of cancer for the Chinese population aged 0–74 years being 1.00 and 0.79 per

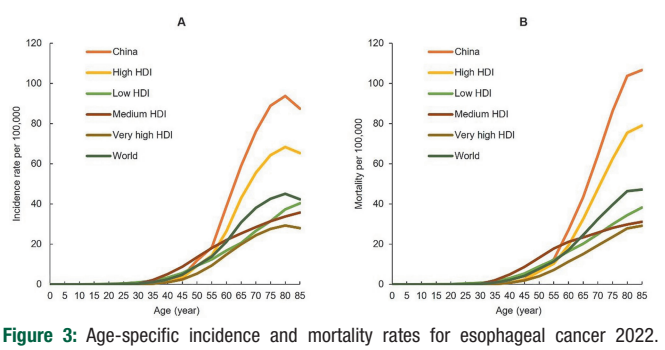

Figure 3: Age-specific incidence and mortality rates for esophageal cancer 2022. (A) Age-specific incidence rate. (B) Age-specific mortality rate. HDI: Human Development Index.

100,000, respectively [Figure 3, Supplementary Figure 7, and Supplementary Tables 4 and 5, http://links.lww.com/CM9/C253].

Esophageal cancer diagnosis and mortality rankings

At the national level, esophageal cancer is the most common cancer in Bangladesh and is among the top five most common cancers in 18 countries. In terms of mortality, esophageal cancer is also the leading cause of cancer-related deaths in Bangladesh and is among the top five causes of cancer-related deaths in 25 countries worldwide. Most of these countries are located in regions such as East Asia, Southeast Asia, and Southern Africa.

In the incidence spectrum, in 2022, esophageal cancer was the most common cancer among male in Bangladesh and was among the top five most common cancers among male in 26 countries. Globally, esophageal cancer was the top five most common cancer among female in 18 countries and was not the most common cancer among female in any country. In the mortality spectrum, esophageal cancer was the leading cause of cancer-related deaths among male in 3 countries worldwide (Bangladesh, Botswana, and Malawi), was among the top three causes of cancer-related deaths among male in 20 countries, and was among the top five causes of cancer-related deaths among male in 39 countries. In 2022, esophageal cancer was the leading cause of cancer-related deaths among female in 1 country (Bangladesh), was among the top three causes of cancer-related deaths among female in 14 countries, and was among the top five causes of cancer-related deaths among female in 25 countries. In China, in 2022, esophageal cancer ranked seventh in incidence and fifth in mortality among all-sex. In the incidence spectrum, esophageal cancer was the fifth most common cancer among male and the tenth most common among female; in the mortality spectrum, esophageal cancer was the fifth leading cause of cancer-related deaths among male and the seventh among female. Globally, the incidence and mortality rates of esophageal cancer in China are at a higher level compared to both the global and Asian regions [Supplementary Table 6, http://links.lww.com/CM9/C253].

Projections of global esophageal cancer burden by 2050

It is projected that by 2050, there will be 922,638 new cases of esophageal cancer worldwide, an increase of 80.5% from 2022; the number of deaths is expected to reach 825,578, an increase of 85.4% from 2022. The greatest increases in both new cases and deaths are expected in countries with lower (by 153.6% and 154.5%, respectively) and medium levels of development (by 106.0% and 104.2%, respectively). In terms of the absolute burden of cancer, high HDI countries are expected to see the largest increase, with a 90.4% increase in new cases (an additional 236,759 cases) and a 104.3% increase in deaths (an additional 232,250 deaths) compared to 2022. By 2050, it is estimated that the number of new esophageal cancer cases in China will rise by 80.2%, reaching 403,627 cases; the number of deaths is expected to increase by 98.2%, reaching 371,521 cases [Figure 4].

Among all world regions, East Africa is projected to have the largest increase in new and death cases of esophageal cancer, with a projected increase of 181.0% in new cases compared to 2022 (an additional 32,463 cases), and an increase of 181.9% in deaths (an additional 30,805 deaths). In terms of the absolute burden of cancer, the East Asia region is expected to see the largest increase. The region is projected to see a 68.7% increase in new cases in 2050 compared to 2022 (an additional 170,748 cases), and an 82.8% increase in deaths (an additional 168,208 deaths) [Supplementary Figure 8, http://links.lww.com/CM9/C253]. These projections are based solely on population growth and aging, and it is anticipated that changes in risk factors may further exacerbate the burden of cancer in the future.

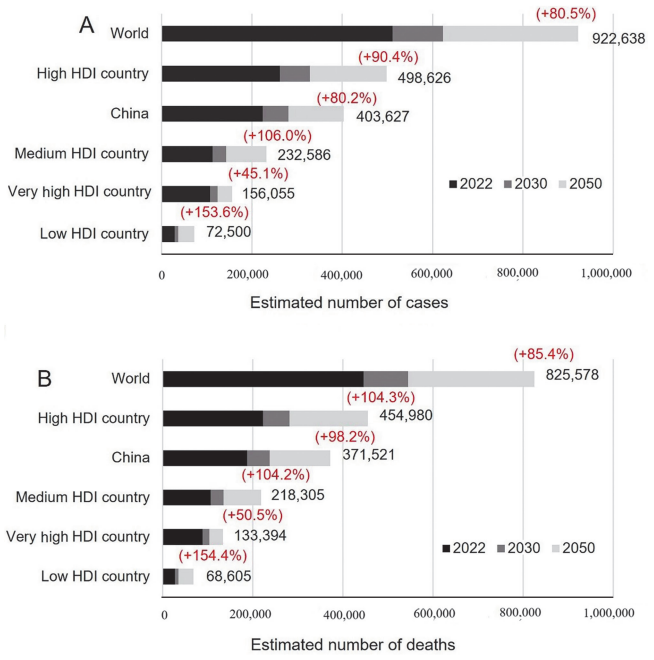

Figure 4: Predicted case number and percentage change of new cases and deaths from primary esophageal cancer between 2022 and 2050. (A) Predicted case number and percentage change in new cases between 2022 and 2050. (B) Predicted case number and percentage change in deaths between 2022 and 2050. HDI: Human Development Index.

Discussion

This article outlines the burden of esophageal cancer incidence and mortality in 185 countries worldwide in 2022. In 2022, about 0.5 million were diagnosed and 0.45 million died. High- incidence/mortality regions include East Africa, Southern Africa, and East Asia. If current rates persist, new cases and deaths will rise over 80% by 2050.

Esophageal cancer mainly affects males. In 2022, global male incidence and mortality are around three times that of females. The greatest sex disparity is observed in Eastern Europe, where the incidence and mortality rates in mela are six to seven times higher than those in female. The reasons for this sex difference are unclear but may involve factors like smoking, alcohol consumption.[9,10] Additionally, differences in sex hormones and obesity may contribute to the predominance of the disease in males.[4,11,12]

In countries with different levels of the HDI, it was found that countries with a very high HDI have the lowest average mortality and incidence ASRs, while countries with a high HDI have the highest average ASR. However, no correlation was observed between HDI and ASR. Additionally, studies have reported that there is no statistically significant correlation between the standardized incidence and mortality rates of esophageal cancer and the HDI and its dimensions.[12,13] Nevertheless, as HDI increases, the mortality-to-incidence ratio tends to decline. A possible reason for this outcome may be that the high HDI group

includes countries with higher incidence and mortality rates, such as China (excluding China, the ASIR and ASMR for the high HDI group are 2.41 and 2.23 per 100,000, respectively). Differences in lifestyle may lead to variations in ASR between countries with very high and high levels of HDI. People in countries with a very high HDI may be more health-conscious, more likely to undergo endoscopic examinations, and thus able to detect potential patients at an early stage, followed by appropriate examination, diagnosis, and timely treatment. Patients with esophageal cancer may receive complete treatment at an early stage, thereby reducing the mortality.[14] Furthermore, adenocarcinoma (AC) and squamous cell carcinoma (SCC) are the two main subtypes of esophageal cancer, each with its own set of risk factors. The risk factors for AC include male sex, obesity, and gastroesophageal reflux,[4–6] while the risk factors for SCC include alcohol consumption and smoking.[7]

Geographically, East Africa and East Asia have the highest ASIR and ASMR for esophageal cancer. In East Africa, high prevalence of dental fluorosis and poor oral hygiene habits are closely associated with high esophageal cancer incidence. Hydrogeological factors also contribute to dental fluorosis risk, which is a main reason for high cancer incidence in the region.[15] In African countries, smoking, drinking, and the use of emetics as a treatment and custom make residents susceptible to esophageal injuries.[9,15,16] Studies show that vomiting from emetics significantly increases the incidence of esophageal cancer, which may be one reason for the high incidence.[17] Low socioeconomic status leads to poor diet and malnutrition, increasing the risk of esophageal cancer. In South Africa's Eastern Cape and Transkei, a diet low in green vegetables and fruits and low plasma concentrations of certain vitamins and minerals due to malnutrition raise the esophageal cancer risk.[18–20] Malawi in southeastern Africa has the highest ASIR and ASMR for esophageal cancer globally, possibly related to lifestyle factors such as smoking, preference for hot food and drinks, smoked fish, cooking with wood fires, and using white jade millet, which are correlated with high incidence of SCC.[21–23]

Over 45% of the world's new and death cases of esophageal cancer occur in East Asia. China bears the heaviest burden in the East Asia region, accounting for over 90% of the new and death cases of esophageal cancer in East Asia, with SCC being the predominant histological type.[24] If China could control the incidence and mortality rates of esophageal cancer to the global average, there would be a reduction of approximately 100,000 cases in both incidence and mortality. The risk factors involved in SCC in China are numerous, including unhealthy lifestyle such as smoking and drinking.[25] As the world's largest producer and consumer of tobacco, China has about 435,000 new cancer cases annually attributed to smoking (360,000 in males and 75,000 in females).[26]

Alcohol is also a high-risk factor for esophageal cancer, with a positive correlation between the amount of alcohol consumed and the risk of cancer. The synergistic effect of smoking and drinking can increase the risk of SCC by 44 times.[27–29] In addition to drinking and smoking, other high-risk factors for esophageal cancer in China include the consumption of fatty meat, pickled vegetables, moldy food, and nutritional factors such as malnutrition. Populations in many high-incidence areas of esophageal cancer in China have been found to lack selenium, zinc, folic acid, riboflavin, and vitamins A, C, E, and B12 in their diets.[30] The local drinking water sources and food samples from local vendors in these areas also contain high levels of nitrates and nitrosamines.[31] In addition, dietary habits such as hot drinks/tea, hot food, and spicy food also increase the risk of esophageal cancer.[32–34]

In terms of the environment, severe air pollution (PM2.5) in China also increases the risk of esophageal cancer, and this risk is higher than the risk attributable to lifestyle factors.[35] In terms of mental health, generalized anxiety disorders also increase the risk of esophageal cancer.[36] Moreover, obesity is also a major risk factor affecting the incidence of SCC. Currently, China has the largest population of obese and overweight individuals, with obesity and overweight rates for those over 18 years old reaching 16.4% and 34.3%, respectively. China is also one of the two countries with the highest number of EC-related deaths due to high body mass index.[37,38] As a lower-middle-income country, the impact of socioeconomic status on the incidence of esophageal cancer in China is relatively small, which may be due to the country's preventive disease propaganda and the popularization of policies.[39]

Historical data shows a decline in esophageal cancer incidence and mortality globally, more pronounced in older individuals. In Asia, countries such as China have experienced a recent decline in esophageal cancer rates due to advancements in medical treatments, changes in risk factors, and adjustments in dietary habits.[40,41] Numerous clinical trials on neoadjuvant and adjuvant therapy may contribute to the decreased mortality.

Although the incidence and mortality rates of esophageal cancer are declining sharply, with the intensification of global population aging and the widespread presence of related risk factors, the projected number of new cases of esophageal cancer is expected to rise to 0.92 million cases, and the number of deaths to 0.83 million cases by 2050, based on the current pace of development. The burden of esophageal cancer on the population remains substantial, making the implementation of effective measures to reduce the disease burden one of the significant public health challenges that need to be addressed currently.

For the prevention of esophageal cancer, it is essential to first identify modifiable risk factors and reduce exposure to these factors (primary prevention). This includes quitting smoking and alcohol consumption and developing good living and dietary habits. Additionally, the most crucial prognostic factor determining survival in esophageal cancer is the stage at the time of diagnosis. However, most cases of esophageal cancer are often diagnosed at a late stage, leading to limited treatment options. Even in high-income countries, the survival rate remains low, resulting in many countries having very similar incidence and mortality rates.

Japan, however, shows a significantly lower mortality rate from esophageal cancer compared to other countries with similar incidence rates. The high survival rate in Japan may be attributed to the country's long-term endoscopic screening program aimed at detecting early stage cancer, allowing for curative endoscopic treatment.[42] Observational studies have demonstrated that screening for esophageal squamous cell carcinoma (ESCC) is associated with a reduction in mortality rates. A one-time screening for individuals aged 40–69 years can reduce the mortality rate of ESCC, potentially lowering the incidence rate of cancer by 30–60% over the next decade.[43,44]

Endoscopic screening for esophageal cancer is hindered by high cost and risk of complications, especially in low-income countries. In China, there are insufficient resources for all asymptomatic adults in high-risk areas. To reduce ESCC mortality through screening, accurate non-endoscopic methods for risk stratification are needed to prioritize high-risk individuals for endoscopic screening.[45]

The data for this article are sourced from the GLOBOCAN 2022 database published by the IARC. There are certain limitations to this study. In some low- or middle-income countries, cancer registration is unequal due to limited surveillance or absent detection systems. GLOBOCAN estimates don't account for the impact of the Corona Virus Disease 2019 (COVID-19) pandemic. Also, 2050 projections have uncertainty and the article lacks a detailed breakdown of esophageal cancer histological types and staging.

In conclusion, we present a geographical overview of the incidence and mortality rates of esophageal cancer in 185 countries for the year 2022, analyzed and projected by sex and HDI. This overview enables governments and researchers to prioritize funding and research in cancer control based on current estimates of the burden of esophageal cancer at regional and national levels. Furthermore, the article highlights the international burden of esophageal cancer, with East Africa, East Asia, Southern Africa, and South-Central Asia being the regions with the highest incidence rates of esophageal cancer in the world. There is a need for further epidemiological research and surveillance by histological subtype, and an increased effort is required to enhance the control of esophageal cancer.

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Conflicts of interest

None.

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