RESEARCH ARTICLE

Editorial Process: Submission:06/29/2025 Acceptance:07/04/2026 Published:07/24/2026

Cancer Burden in Bangladesh: Age- and Sex-Specific Incidence, Prevalence, Mortality, and Forecasts Up to 2050

Hemayet Hossain[1,2], Khadiza Akter Brishty[3], Md. Shahidur Rahman Chowdhury[4], Asikur Rahman[4], Sofiur Muktadir[5], Kasim Sakran Abass[6], Md. Masudur Rahman[7], Md. Mahfujur Rahman[4]*

Abstract

Background: Cancer poses a formidable health crisis and major public health challenge in Bangladesh, while globally it remains among the leading causes of morbidity and mortality across all ages. This study aimed to explore the age- and sex-specific incidence, mortality, and prevalence of cancers in Bangladesh. **Methods:** This study was based on secondary, modeled data obtained from the Global Cancer Observatory (GCO), GLOBOCAN 2022 database developed by the International Agency for Research on Cancer under the World Health Organization, with supplementary estimates retrieved from the Global Burden of Disease (GBD) Study. **Results:** In 2022, Bangladesh recorded 167,256 new cancer cases and 116,598 cancer-related deaths, with higher age-standardized incidence and mortality rates observed in males. The leading cancers by incidence (per 100,000) were esophagus (16.0), breast (15.2), cervix uteri (11.3), lip and oral cavity (10.3), and lung cancers (8.8). Notably, Bangladesh ranked first globally for esophageal cancer incidence (16.0) and mortality (15.3). Prevalence was the highest for breast and oral cavity cancers. Age-specific patterns revealed that leukemia and non-Hodgkin lymphoma (NHL) were predominant in children, while breast, cervix, esophageal, and lung cancers became more common in adults and the elderly. Forecasts suggest that by 2050, new cancer cases will rise to 348,000 and deaths to 252,000, nearly doubling the current burden. **Conclusions:** Significant increases are expected for trachea, bronchus, lung, and gallbladder cancers. Esophageal cancer is projected to remain the leading cause of cancer-related deaths, while leukemia, breast, cervix, and gallbladder cancers will continue to exert substantial impacts across different age groups. These trends underscore the urgent need for targeted prevention, early detection, and comprehensive cancer control strategies in Bangladesh.

Keywords: Cancer burden- Esophageal cancer- Incidence- Mortality- Bangladesh

Asian Pac J Cancer Prev, **27 (7)**, 2467-2479

Introduction

Cancer is a major global health concern [1] and a growing problem in developing countries like Bangladesh. The country faces unique challenges in cancer prevention, early detection, and treatment, including limited medical infrastructure, late-stage diagnoses, social stigma, and a shortage of specialized care [2, 3].

The International Agency for Research on Cancer (IARC) reported 19.3 million new cancer cases and nearly 10 million deaths globally in 2020 [4, 5], which increased to nearly 20 million new cases and 9.7 million deaths in 2022, including nonmelanoma skin cancers (NMSCs) [6]. According to the Bangladesh Cancer Society (BCS), cancer accounts for about 10% of all deaths and ranks sixth among leading causes [2].

Eastern Asia reported over 6.1 million new cancer cases in 2022, while Northern America had 2.67 million, and South-Central Asia including Bangladesh recorded more than 2 million cases. Globally, nearly 20 million new cancer cases and 9.7 million deaths were documented, underscoring regional disparities in cancer burden. These contrasts highlight Bangladesh's disproportionately high incidence of esophageal cancer and situate its national burden within the wider global landscape [6].

Despite the rising impact, national cancer registries remain weak, likely underestimate the true burden. Investment in comprehensive cancer control programs

*[1]Department of Anatomy and Histology, Sylhet Agricultural University, Sylhet, Bangladesh. [2]Department of Veterinary Science and Animal Husbandry, Teesta University, Rangpur, Bangladesh. [3]Department of Zoology (GSSC), University of Dhaka, Dhaka, Bangladesh. [4]Department of Medicine, Sylhet Agricultural University, Sylhet, Bangladesh. [5]Faculty of Animal Science and Veterinary Medicine (FASVM), Patuakhali Science and Technology University (PSTU), Dumki, Patuakhali, Bangladesh. [6]Department of Physiology, Biochemistry, and Pharmacology, College of veterinary medicine, University of Kirkuk, Kirkuk, Iraq. [7]Department of Pathology, Sylhet Agricultural University, Sylhet, Bangladesh. *For Correspondence: mahfuj.vetmed@sau.ac.bd. Hemayet Hossain and Khadiza Akter Brishty have equal contribution in this study.*

spanning from information campaigns, screening programs at an early stage, and low-cost treatment is critically low compared to needs. There were about 167,256 new cancer cases and 116,598 cancer related deaths in 2022 in Bangladesh [3]. The age-standardized incidence ratios (ASIR) were 120.8 per 100,000 in males and 89.5 per 100,000 females. The chances of a person developing cancer before the age of 75 years were 13.0% for men and 9.3% for women. The chances of dying from cancer at this age or younger were 9.7% for men and 6.6% for women [3, 7]. Recent epidemiological studies show a significant rise in most cancer types in Bangladesh over the past two decades [5]. The increasing trend gets even more startling with the aging population of the country and changes in lifestyle trends. The cancer burden is expected to rise further by 2050 unless effective control strategies are implemented.

Cancer incidence in Bangladesh shows diverse age-specific and sex-specific patterns. The age pattern of cancer shows usual patterns, as some cancers arise in youths, whereas others show rising incidence with advancing age [8]. The incidence of cancer is mostly observed in middle-aged and elderly populations [9]. Similarly, sex-based disparities in cancer incidence and mortality reflect the influence of biological differences and gender-specific risk factors [10].

Lung cancer and mouth and oropharyngeal cancers are the leading cancer types among males. Other commonly diagnosed cancers in men include esophageal, gastric, lymphatic cancers, and multiple myeloma. In females, the most prevalent cancers are those of the mouth and oropharyngeal, esophageal, cervix and breast [11]. The high and widespread cervical and breast cancer rates reinforce the need for national mass screening programs, human papillomavirus (HPV) immunization, and outreach education, especially in rural and underprivileged communities [12].

Cultural taboos, gender disparities in access to healthcare, and low cancer awareness among women are responsible for delay in diagnosis and poor prognosis [13]. Addressing cancer in Bangladesh requires an integrated strategy that accounts for age, gender, and socio-economic disparities to strengthen prevention, early detection, and care. The rising burden across 32 cancer types, with clear age- and sex-specific trends, underscores the need for urgent, long-term action. To date, no study has simultaneously examined age- and sex-specific cancer burden alongside long-term projections to 2050 using harmonized secondary data sources for Bangladesh.

However, this study aimed (i) to quantify the age- and sex-specific incidence, prevalence, and mortality of cancer in Bangladesh using GLOBOCAN 2022 data; (ii) to identify the leading cancer types and their demographic patterns across different age groups; (iii) to assess sex-based disparities in cancer burden; and (iv) to project future trends in cancer incidence and mortality up to 2050 in order to inform targeted prevention, early detection, and national cancer control strategies.

Materials and Methods

Data Sources

Cancer burden data for Bangladesh were extracted from the Global Cancer Observatory (GCO), GLOBOCAN 2022 database (https://gco.iarc.fr/en), developed by the International Agency for Research on Cancer (IARC) (https://www.iarc.who.int/), World Health Organization (WHO). For cross-verification and supplementary insights, data were also retrieved from the Global Burden of Disease (GBD) 2021 (https://ghdx.healthdata.org/gbd-2021) study managed by the Institute for Health Metrics and Evaluation (IHME). Additional predictions were derived using the Cancer Tomorrow tool (GCO, Version 1.1, https://gco.iarc.fr/tomorrow/en).

Cancer Classification

Cancer types were classified according to the International Classification of Diseases, 10th Revision (ICD-10, Version 2010). A total of 32 specific cancer types, including non-melanoma skin cancer (NMSC), and two aggregated categories (all cancers and all cancers excluding NMSC) were analyzed. Each cancer was identified using corresponding ICD-10 codes (e.g., C00–06 for lip and oral cavity, C15 for esophagus, C50 for breast) (Supplementary Table S1).

Data Retrieval and Indicators

From the GCO database, the following epidemiological indicators were extracted separately for males and females across the 0–84-year age group:

Incidence

Number of new cases and age-standardized incidence rates (ASR per 100,000 population).

Mortality

Number of cancer-related deaths and age-standardized mortality rates (ASMR per 100,000 population).

Cumulative Risk

Risk (%) of developing or dying from cancer before the age of 75 years.

Prevalence

Estimated number of 1-, 3-, and 5-year prevalent cases.

Prevalence estimates were computed using sex-, site-, and age-specific incidence-to-prevalence ratios based on Nordic country data (2011–2020). These ratios were adjusted for Bangladesh by applying Human Development Index (HDI)-based correction factors provided within the GLOBOCAN methodology. The HDI adjustment accounts for differences in survival patterns and healthcare access between high-HDI reference populations and lower-HDI settings such as Bangladesh, thereby modifying the modeled survival proportions used to estimate 1-, 3-, and 5-year prevalence.

Mortality estimates were derived from modeled national incidence data, applying mortality-to-incidence ratios (MIRs) calculated from survival estimates.

Ranking of Cancer Types

Cancer sites were ranked based on the number of incident cases, deaths, and cumulative risks for both sexes combined. The ranking included separate analyses for males and females and was used to identify the top 20 cancers contributing to the overall cancer burden.

Age-Specific Analysis

Age-specific incidence and mortality were explored across 14-year intervals for the top five cancer types in both sexes. Distinct trends were analyzed for pediatric, adolescent, adult, and elderly populations.

Forecasting Cancer Burden (2022–2050)

Future projections of cancer incidence and mortality in Bangladesh were generated using the Cancer Tomorrow database (GCO, Version 1.1, https://gco.iarc.fr/tomorrow/en). Forecasts assumed an annual percentage change (APC) of 5%, a conservative estimate based on global cancer trends [14]. Projections included estimates of total new cases, deaths, and site-specific burdens up to the year 2050.

Visualization and Statistical Analysis

Primary graphical outputs were retrieved from the GCO visualization tool. Figures were subsequently customized and refined to align with study objectives using Microsoft Excel 2019, Adobe Photoshop 2022, and GraphPad Prism Version 8.4. Rates were expressed per 100,000 populations and stratified by sex, cancer site, and age group. Descriptive statistics (e.g., counts, percentages, rates) were used for summarizing cancer burden. No inferential statistical tests were applied because the study relied on pre-modeled, aggregated data sources.

Results

Cancer Burden by Sex

In 2022, a total of 167,256 new cancer cases were reported in Bangladesh, with 94,922 cases among males and 72,334 among females (Table 1). The age-standardized incidence rate (ASIR) was higher in males (120.8 per 100,000) compared to females (89.5 per 100,000). The cumulative risk of developing cancer before the age of 75 was 13.0% for males and 9.3% for females.

Cancer-related deaths totaled 116,598, with 68,591 deaths among males and 48,007 among females. The age-standardized mortality rate (ASMR) was 87.8 per 100,000 for males and 60.9 per 100,000 for females. The cumulative risk of dying from cancer before age 75 was 9.7% for males and 6.6% for females. The 5-year prevalence was estimated at 346,337 cases, with a higher prevalence in males (181,944) than females (164,393), as shown in Table 1.

Based on the age-standardized rates (ASR) in Bangladesh for individuals aged 0–84 years, the top five cancer sites by incidence (per 100,000) were oesophagus (16.0), breast (15.2), cervix uteri (11.3), lip and oral cavity (10.3), and lung (8.8) (Figure 1a).

However, when considering mortality (per 100,000), esophageal cancer remained the leading cause (15.3), followed by lung (8.2), breast (7.6), cervix uteri (7.0), and lip and oral cavity cancers (6.1). Among gastrointestinal tract cancers, stomach cancer showed a higher mortality in males, with an ASR of 6.6 and an incidence of 7.4 per 100,000. Conversely, gallbladder cancer was more prevalent in females, with an incidence and mortality of 7.7 and 6.1 per 100,000, respectively (Figure 1b). Notably, breast cancer exhibited a considerable gap between incidence and mortality. While the incidence (per 100,000) was 15.2, mortality was nearly half at 7.6,

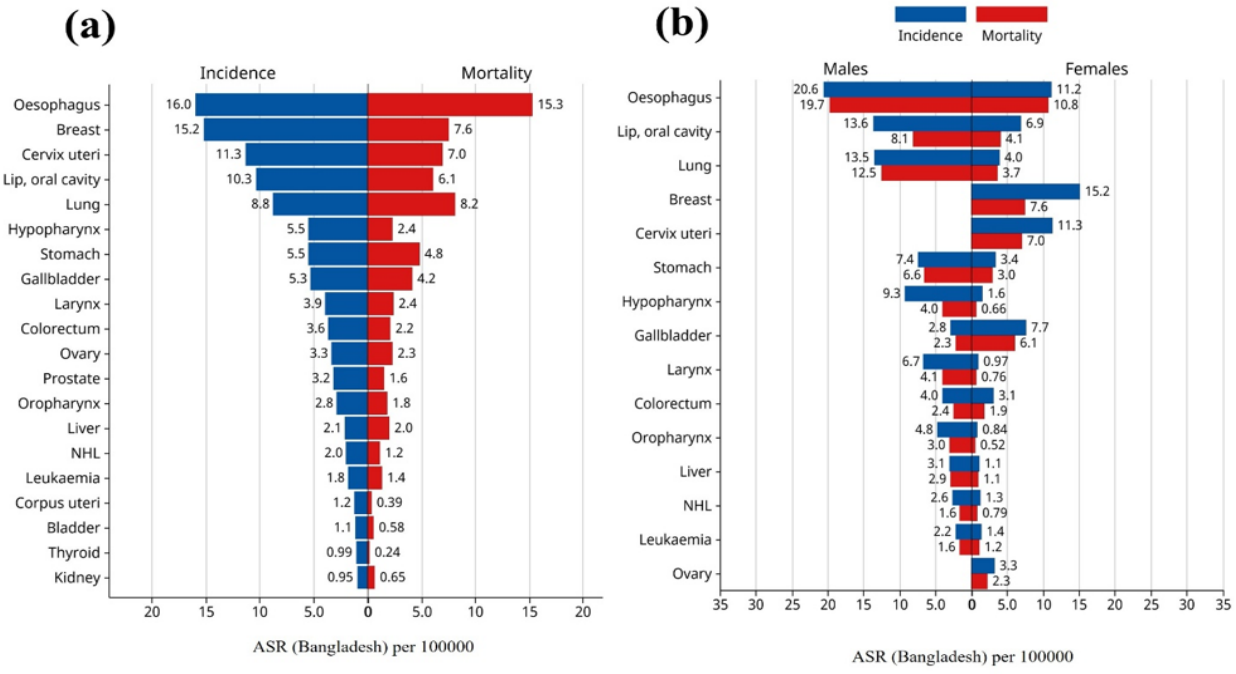

Figure 1. Age-Standardized Incidence and Mortality Rates (ASR per 100,000 population) of the Top 15 Cancer Types in Bangladesh among Individuals aged 0–84 Years.

Table 1. Overall Cancer Incidence, Prevalence, Mortality, and Cumulative Risk by Sex in Bangladesh, 2022.

Measures		Males	Females	Both sexes
Population[a]		84,788,982	83,096,698	16,885,680
Incidence*	No. of new cancer cases	94,922	72,334	167,256
	Age-standardized incidence rate	120.8	89.5	105.6
	Risk of developing cancer before the age of 75 years (cum. risk %)	13	9.3	11.3
Mortality*	Number of cancer deaths	68,591	48,007	116,598
	Age-standardized mortality rate	87.8	60.9	74.7
	Risk of dying from cancer before the age of 75 years (cum. risk %)	9.7	6.6	8.2
Prevalence*	1-year prevalent cases	54,069	44,127	98,196
	3-year prevalent cases	126,355	110,704	237,059
	5-year prevalent cases	181,944	164,393	346,337

[a]Based on Global Cancer Observatory (Globocan 2022); *includes non-melanoma skin cancer (NMSC)

as shown in Figure 1b.

Cancer Site-Specific Burden

The most common cancers in terms of incidence were esophageal cancer (15.1%), lip and oral cavity cancers (9.6%), lung cancer (7.8%), and breast cancer (7.8%). Esophageal cancer also accounted for the highest number of deaths (20.9%), followed by lung (10.3%), lip and oral cavity (8.1%), and stomach cancers (6.3%) (Table 2).

Lung cancer (trachea, bronchus, and lung) ranked third in incidence (7.8%) with 13,000 new cases and second in mortality with a high fatality rate (10.3%) with 12,063

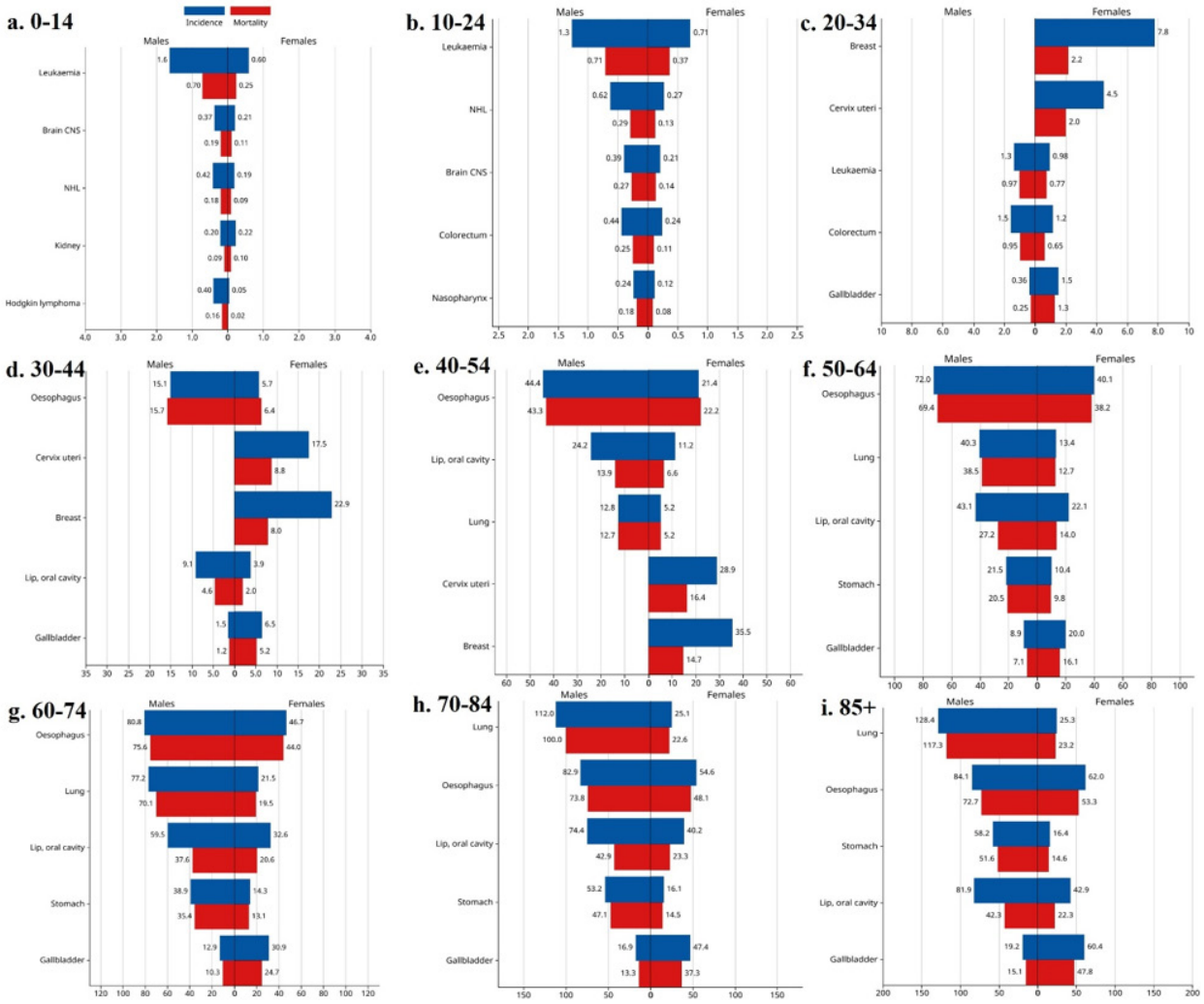

Figure 2. Distribution of the Top Five Cancer Types in Bangladesh by Predominant Age Group, Showing Age-Standardized Incidence and Mortality Rates per 100,000 Populations for Both Sexes

Table 2. Ranking of Cancer Burden in Bangladesh by 32 Cancer Sites in 2022. Data include the number of new cases, deaths, cumulative risk of developing or dying from each cancer, and 1-, 3-, and 5-year prevalence rates per 100,000 population

Cancer site	Incidence			Mortality			No. of prevalent cases; Proportions (per 100000)		
	No. of new cases; %	Rank	Cum. risk	No. of deaths; %	Rank	Cum. risk	1-year pre.	3-year pre.	5-year pre.
Esophagus	25232 (15.1)	1	1.8	24363 (20.9)	1	1.8	16202 (9.65)	32263 (19.22)	42160 (25.1)
Lip, oral cavity	16083 (9.6)	2	1.2	9447 (8.1)	3	0.74	9815 (5.85)	26136 (15.57)	40190 (23.9)
Trachea, bronchus and lung	13000 (7.8)	3	1.1	12063 (10.3)	2	1	6895 (4.11)	13729 (10.61)	17812 (10.6)
Breast	12989 (7.8)	4	1.6	6162 (5.3)	6	0.81	8414 (10.13)	23127 (27.83)	35269 (42.4)
Cervix uteri	9640 (5.8)	5	1.2	5826 (5.0)	7	0.76	6160 (7.41)	17077 (20.55)	26698 (32.1)
Hypopharynx	8491 (5.1)	6	0.65	3555 (3.0)	9	0.29	4511 (2.69)	10181 (6.06)	14415 (8.6)
Gallbladder	8380 (5.0)	7	0.58	6660 (5.7)	5	0.46	5345 (3.18)	10641 (6.34)	13630 (8.1)
Stomach	8365 (5.0)	8	0.65	7359 (6.3)	4	0.58	4638 (2.76)	9800 (5.84)	13390 (8.0)
Larynx	5975 (3.6)	9	0.46	3740 (3.2)	8	0.29	3698 (2.2)	10293 (6.13)	16289 (9.7)
Colorectum	5723 (3.4)	10	0.4	3457 (3.0)	10	0.24	3536 (2.11)	9376 (5.58)	14167 (8.4)
Oropharynx	4438 (2.7)	11	0.33	2792 (2.4)	12	0.22	2738 (1.63)	7276 (4.33)	11075 (6.6)
Liver and intrahepatic bile ducts	3228 (1.9)	12	0.24	3069 (2.6)	11	0.23	1751 (1.04)	3468 (2.07)	4409 (2.6)
Non-Hodgkin lymphoma	3096 (1.9)	13	0.22	1876 (1.6)	14	0.14	1908 (1.14)	5330 (3.17)	8438 (5.0)
Leukaemia	2948 (1.8)	14	0.17	2301 (2.0)	13	0.13	1821 (1.08)	5035 (3.0)	7879 (4.7)
Ovary	2846 (1.7)	15	0.33	1857 (1.6)	15	0.26	1795 (2.16)	4923 (5.92)	7539 (9.1)
Prostate	2335 (1.4)	16	0.4	1160 (1.0)	18	0.18	1358 (1.6)	3377 (3.98)	4728 (5.6)
Thyroid	1671 (1.0)	17	0.1	366 (0.31)	24	0.03	1037 (0.62)	2904 (1.73)	4533 (2.7)
Bladder	1633 (0.98)	18	0.13	880 (0.76)	20	0.07	1024 (0.61)	2807 (1.67)	4367 (2.6)
Kidney	1440 (0.86)	19	0.1	969 (0.83)	19	0.07	845 (0.5)	2278 (1.36)	3462 (2.1)
Pancreas	1377 (0.82)	20	0.1	1320 (1.1)	16	0.1	759 (0.45)	1420 (0.85)	1783 (1.1)
Brain CNS	1341 (0.80)	21	0.08	1193 (1.0)	17	0.08	870 (0.52)	2626 (1.56)	4346 (2.6)
Corpus uteri	995 (0.60)	22	0.13	302 (0.26)	25	0.05	650 (0.78)	1869 (2.25)	3021 (3.6)
Nasopharynx	970 (0.58)	23	0.07	749 (0.64)	21	0.05	607 (0.36)	2592 (1.54)	2592 (1.5)
Salivary glands	851 (0.51)	24	0.06	567 (0.49)	23	0.04	541 (0.32)	1467 (0.87)	2265 (1.4)
Multiple myeloma	780 (0.47)	25	0.06	703 (0.60)	22	0.05	468 (0.28)	1244 (0.78)	1825 (1.1)
Penis	684 (0.41)	26	0.09	244 (0.21)	27	0.03	435 (0.51)	1181 (1.39)	1826 (2.2)
Hodgkin lymphoma	522 (0.31)	27	0.03	203 (0.17)	28	0.01	340 (0.2)	1002 (0.6)	1625 (0.97)
Melanoma	430 (0.26)	28	0.03	262 (0.23)	26	0.02	280 (0.17)	778 (0.46)	1198 (0.71)
Testis	404 (0.24)	29	0.03	101 (0.09)	31	0.01	267 (0.31)	782 (0.92)	1288 (1.5)
Vulva	287 (0.17)	30	0.04	139 (0.12)	29	0.02	180 (0.22)	495 (0.6)	767 (0.92)
Vagina	238 (0.14)	31	0.03	108 (0.09)	30	0.02	143 (0.17)	361 (0.43)	524 (0.63)
Mesothelioma	9 (0.01)	32	0	8 (0.01)	32	0	7 (<0.01)	10 (0.01)	15 (0.01)
All cancers	167256		11.3	116598		8.2	98196 (58.49)	237059 (141.2)	346337 (206.29)
All cancers excl. NMSC	166093		11.2	116062		8.2	97436 (58.04)	234977 (139.96)	343127 (204.38)

Rankings are based on incidence and mortality burden; NMSC, Non-melanoma skin cancer,

deaths. Breast cancer ranked fourth in overall incidence but was the most prevalent cancer among females, contributing significantly to the 1-year (10.13%), 3-year (27.83%), and 5-year (42.4%) prevalence rates. Among females, cervix cancer also showed a considerable burden, with 9,640 new cases and 5,826 deaths, ranking fifth in incidence and seventh in mortality. Colorectal cancer (5,723 cases) ranked tenth in incidence, while liver and intrahepatic bile duct cancer (3,228 cases) and non-Hodgkin lymphoma (3,096 cases) had moderate burdens. Cancers such as prostate, ovary, thyroid, bladder, and kidney contributed moderately to the cancer burden. Rare cancers like penile (684 cases), testicular (404 cases), vulvar (287 cases), vaginal (238 cases), and mesothelioma (9 cases) accounted for a small proportion of the overall burden.

In contrast, among males, the highest incidence was seen in esophageal (15,098 cases), oral cavity (9,347 cases), and lung cancers (7,781 cases). The cumulative risk of developing esophageal cancer before age 75 was 2.3% in males and 1.3% in females. Similarly, the risk of dying from this cancer was high in both sexes: 2.2% in males and 1.2% in females (Table 3).

Age-Standardized Incidence and Mortality by Sex

A distinct disparity in cancer incidence and

Table 3. Incidence and Mortality of 33 Specific Cancers and All Cancers Combined (Including Non-Melanoma Skin Cancer Except Basal Cell Carcinoma) in Bangladesh by Sex in 2022 -Number of Cases, Age-Standardized Rates, and Cumulative Risk

Cancer site	Incidence						Mortality					
	Males			Females			Males			Females		
	No. of cases	ASR (%)	Cum. Risk; 0-74 years	No. of cases	ASR (%)	Cum. Risk; 0-74 years	No. of cases	ASMR (%)	Cum. Risk; 0-74 years	No. of cases	ASMR (%)	Cum. Risk; 0-74 years
All cancers excl. non-melanoma skin cancer	81031	107.1	13	63431	82	9.3	58017	77.2	9.7	41112	54.9	6.6
Lip, oral cavity	9347	12.2	1.6	4458	6.2	0.81	5580	7.4	0.96	2681	3.8	0.5
Salivary glands	474	0.62	0.08	269	0.35	0.04	322	0.43	0.06	169	0.23	0.03
Oropharynx	3406	4.4	0.55	556	0.75	0.09	2211	2.9	0.36	350	0.48	0.06
Nasopharynx	629	0.81	0.1	266	0.33	0.04	489	0.63	0.08	199	0.25	0.03
Hypopharynx	6482	8.5	1.1	1026	1.4	0.18	2589	3.5	0.49	399	0.57	0.08
Esophagus	15098	19.3	2.3	7440	10.1	1.3	14696	18.6	2.2	7341	9.9	1.2
Stomach	4627	6.4	0.88	2395	3.2	0.39	4112	5.7	0.8	2054	2.8	0.35
Colo-rectum	2850	3.7	0.46	2010	2.7	0.34	1702	2.2	0.27	1146	1.6	0.2
Liver and intrahepatic bile ducts	1753	2.4	0.34	725	1	0.13	1667	2.3	0.32	688	0.96	0.12
Gallbladder	1888	2.5	0.33	4970	6.6	0.84	1510	2	0.26	3948	5.3	0.67
Pancreas	730	0.95	0.12	451	0.62	0.08	706	0.92	0.11	452	0.63	0.08
Larynx	4497	6	0.79	615	0.84	0.11	2623	3.5	0.48	462	0.64	0.09
Trachea, bronchus and lung	7781	11.1	1.6	2472	3.6	0.49	7259	10.3	1.5	2296	3.3	0.45
Melanoma of skin	210	0.3	0.04	107	0.14	0.02	122	0.17	0.02	62	0.08	0.01
Mesothelioma	3	0	0	6	0.01	0	3	0	0	5	0.01	0
Kaposi sarcoma	0	0	0	0	0	0	0	0	0	0	0	0
Penis	597	0.75	0.09	.	.	.	205	0.27	0.03	.	.	.
Prostate	1675	2.5	0.4	.	.	.	755	1.1	0.18	.	.	.
Testis	395	0.42	0.03	.	.	.	99	0.11	0.01	.	.	.
Breast	.	.	.	12068	14.5	1.6	.	.	.	5324	6.8	0.81
Vulva	.	.	.	238	0.32	0.04	.	.	.	129	0.17	0.02
Vagina	.	.	.	190	0.27	0.03	.	.	.	91	0.13	0.02
Cervix uteri	.	.	.	9189	11	1.2	.	.	.	5394	6.7	0.76
Corpus uteri	.	.	.	943	1.2	0.13	.	.	.	265	0.36	0.05
Ovary	.	.	.	2710	3.2	0.33	.	.	.	1724	2.2	0.26
Kidney	554	0.8	0.12	492	0.69	0.08	340	0.52	0.08	269	0.4	0.05
Bladder	1047	1.4	0.21	235	0.33	0.04	493	0.71	0.11	110	0.16	0.02
Brain, central nervous system	780	0.97	0.1	493	0.61	0.06	690	0.86	0.1	439	0.55	0.06
Thyroid	459	0.57	0.07	933	1.2	0.13	104	0.15	0.02	113	0.17	0.03
Hodgkin lymphoma	362	0.43	0.04	156	0.2	0.02	140	0.17	0.01	60	0.08	0.01
Non-Hodgkin lymphoma	1907	2.5	0.29	824	1.1	0.14	1152	1.5	0.18	464	0.65	0.09
Multiple myeloma	342	0.47	0.07	239	0.33	0.04	307	0.43	0.06	218	0.31	0.04
Leukaemia	1598	2	0.19	1137	1.4	0.14	1191	1.5	0.15	920	1.1	0.12

ASR, age-standardized rate; Cum. Risk, cumulative risk; ASMR, Age Standardized Mortality Ratio (ASMR)

mortality was observed between males and females in Bangladesh (Table 3). Males exhibited significantly higher age-standardized incidence rates (ASR) and age-standardized mortality rates (ASMR) than females across most cancer types. For all cancers excluding non-melanoma skin cancer (NMSC), the ASR (per 100,000) among males was 107.1, while in females it was 82.0. The mortality ASR (per 100,000) was also higher in males (77.2) compared to females (54.9). Additionally, the cumulative risk of developing any cancer before the age of 75 was 13.0% in males and 9.3% in females, while the risk of dying from cancer was 9.7% and 6.6%, respectively.

The ASR of lung cancer was 11.1 in males versus 3.6 in females; similarly, oral cavity cancer ASR was 12.2 in males and 6.2 in females. Female-specific cancers such as breast (14.5) and cervix uteri (11.0) were leading contributors to cancer burden among women, with cumulative risks of 1.6% and 1.2%, respectively.

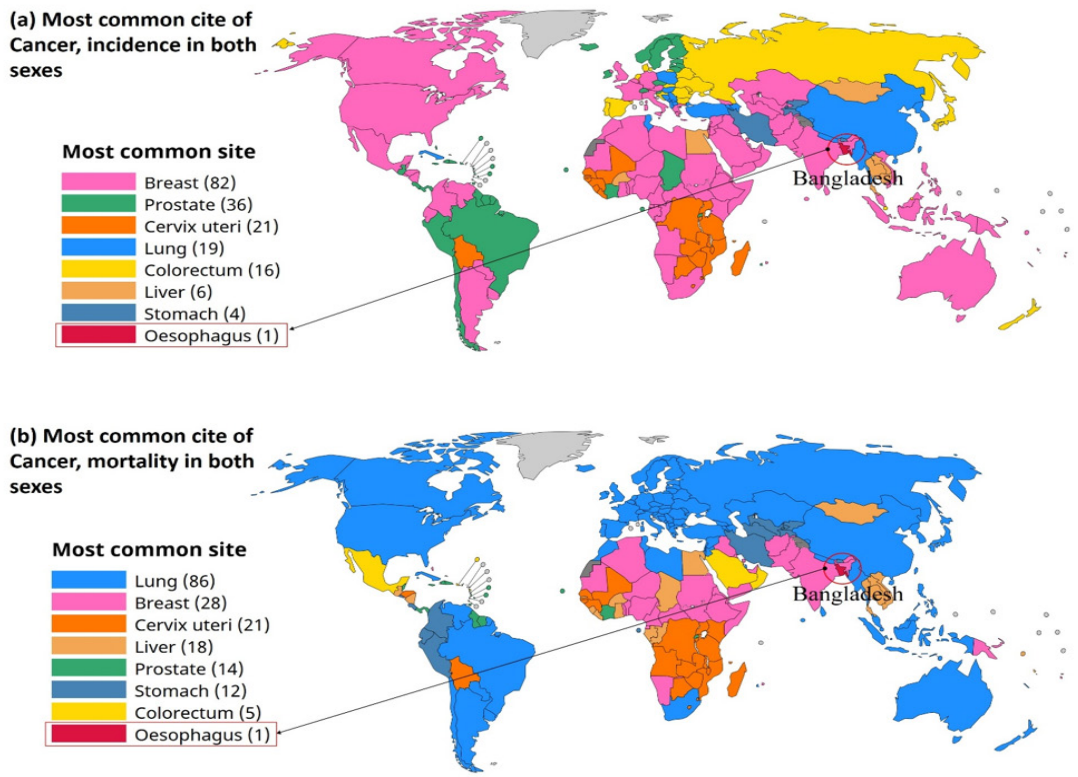

Figure 3. Most Common Cancer Site by Country in 2022 (Excluding Non-Melanoma Skin Cancer), based on Highest Incidence in Both Sexes. Figure 3a: Global ranking of countries based on the highest incidence of cancer; Figure 3b: Global ranking of countries based on the highest cancer-related mortality.

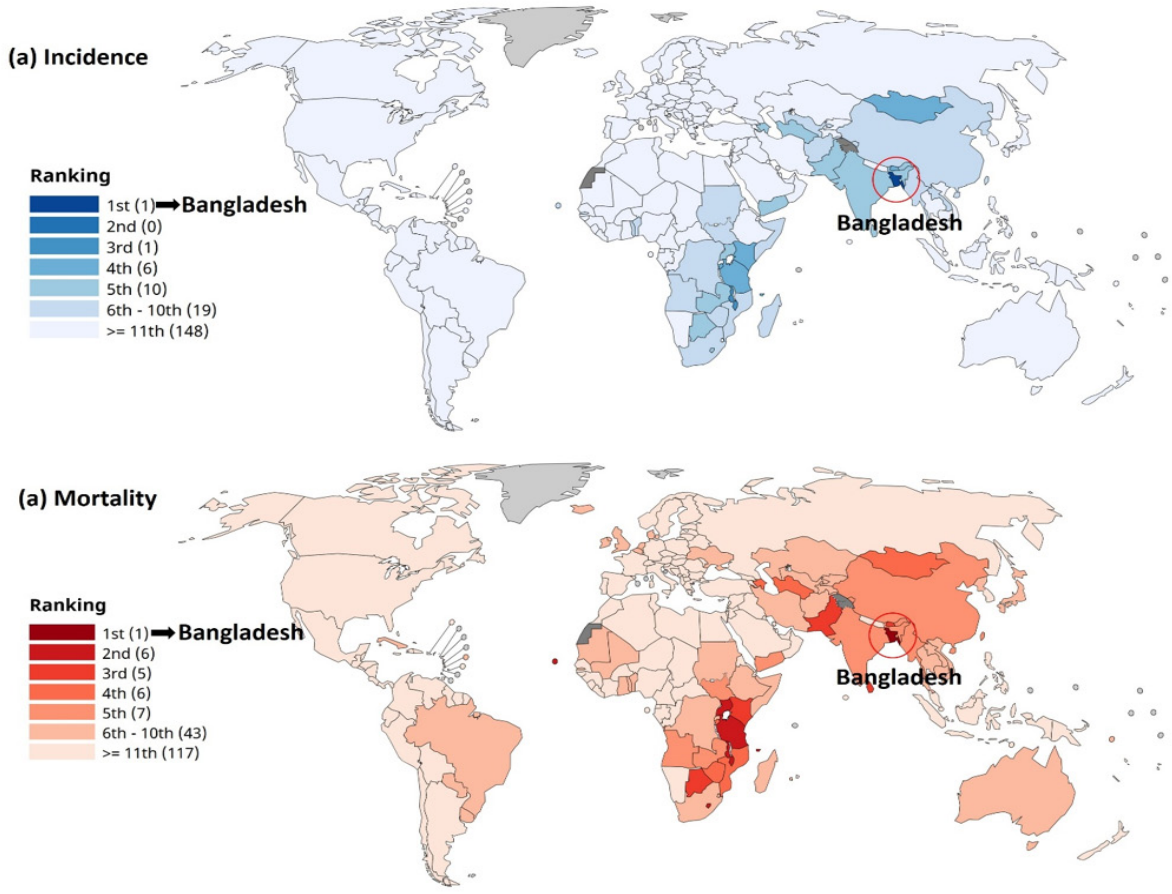

Figure 4. The Choropleth Map Represents the Global Ranking of Esophageal Cancer in both Sexes in 2022. Figure 4a: Global ranking based on incidence of esophageal cancer in 2022. Figure 4b: Global ranking based on mortality from esophageal cancer in 2022.

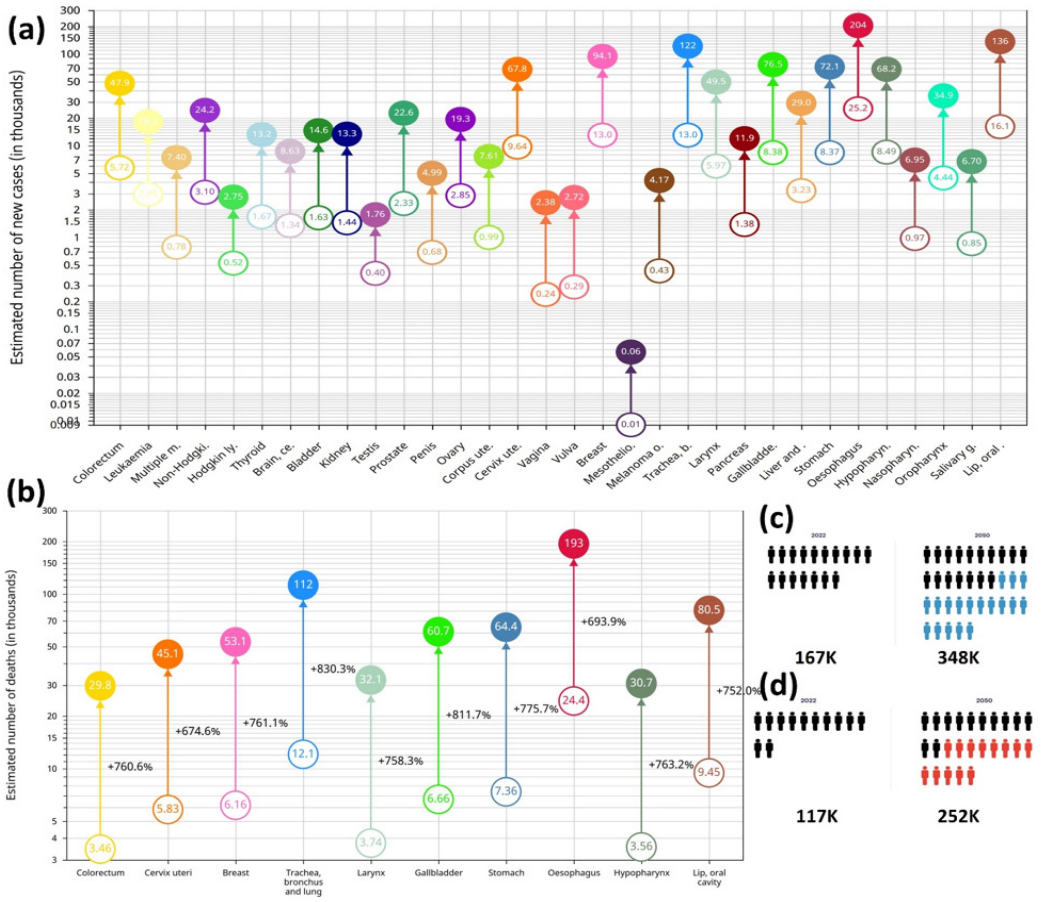

Figure 5. Projected Number of New Cancer Cases (Panels A & C) and Estimated Cancer-Related Deaths (Panels B & D) in both sexes aged 0–84 years from 2022 to 2050, assuming an annual percentage change of 5%. Primarily Data retrieve from: Cancer Tomorrow: IARC; Data Version Globocan 2022 (Version 1.1).

Rare Cancers

Some cancers showed relatively low incidence and mortality but were still noteworthy. Thyroid cancer was more common in females (933 cases; ASR 1.2) than in males (459 cases; ASR 0.57). Cancers such as testicular (395 male cases), penile (597 cases), and vaginal/vulvar cancers in females were rare, with incidence below 0.5%. Mesothelioma and Kaposi sarcoma were the least common cancers and showed minimal contribution to the national cancer burden and each reporting less than 10 cases in 2022.

Age dependent incidence and mortality

This study found that different types of cancer emerge at different stages of life and contribute significantly to mortality across various age groups (Figure 2). At early stages of life, Leukemia was prevalent in both male and female children, but males are more susceptible, with an incidence rate of 1.6 (age-standardized ratio, ASR, per 100,000) and a mortality rate of 0.7. Both the incidence and mortality rates for non-Hodgkin lymphoma (NHL) are alarmingly high in the 0-14- and 10-24-year age group. Additionally, in females, the onset of female genital tract cancers becomes more prominent during this stage, especially breast and cervix uteri cancers. Breast and Cervix uteri cancer is most prevalent in females aged 20-34 years. Gallbladder cancer is significantly more common in females, starting at ages 20-34 and continuing until 85 years.

Lip and oral cavity cancers emerge most frequently in the 30-44 years age group, with incidence and mortality rates of 9.1 and 4.6, respectively, in males, compared to 3.9 and 2.0 in females. Esophageal cancer ranks first in incidence and mortality between the ages of 30 and 74 years, with males being more susceptible than females. At middle to older ages, lung and stomach cancers begin to emerge, continuing to be the leading causes of death until the age of 85 or older.

Global Perspective on Esophageal Cancer

In 2022, Bangladesh recorded the highest number of esophageal cancer cases globally and was the only country with the highest mortality attributed to this cancer type (Figure 3). According to GLOBOCAN 2022, Bangladesh ranked first among all countries in both incidence (16.0 ASR per 100000) and mortality (15.3 ASR per 100000) for esophageal cancer (Figure 4). Furthermore, lung cancer (Mortality 8.2 ASR per 100000) was identified as the second leading cause of cancer-related deaths in Bangladesh. On a global scale, lung cancer was the top cause of cancer mortality in 86 countries. Breast cancer was the most common incident cancer in 82 countries worldwide.

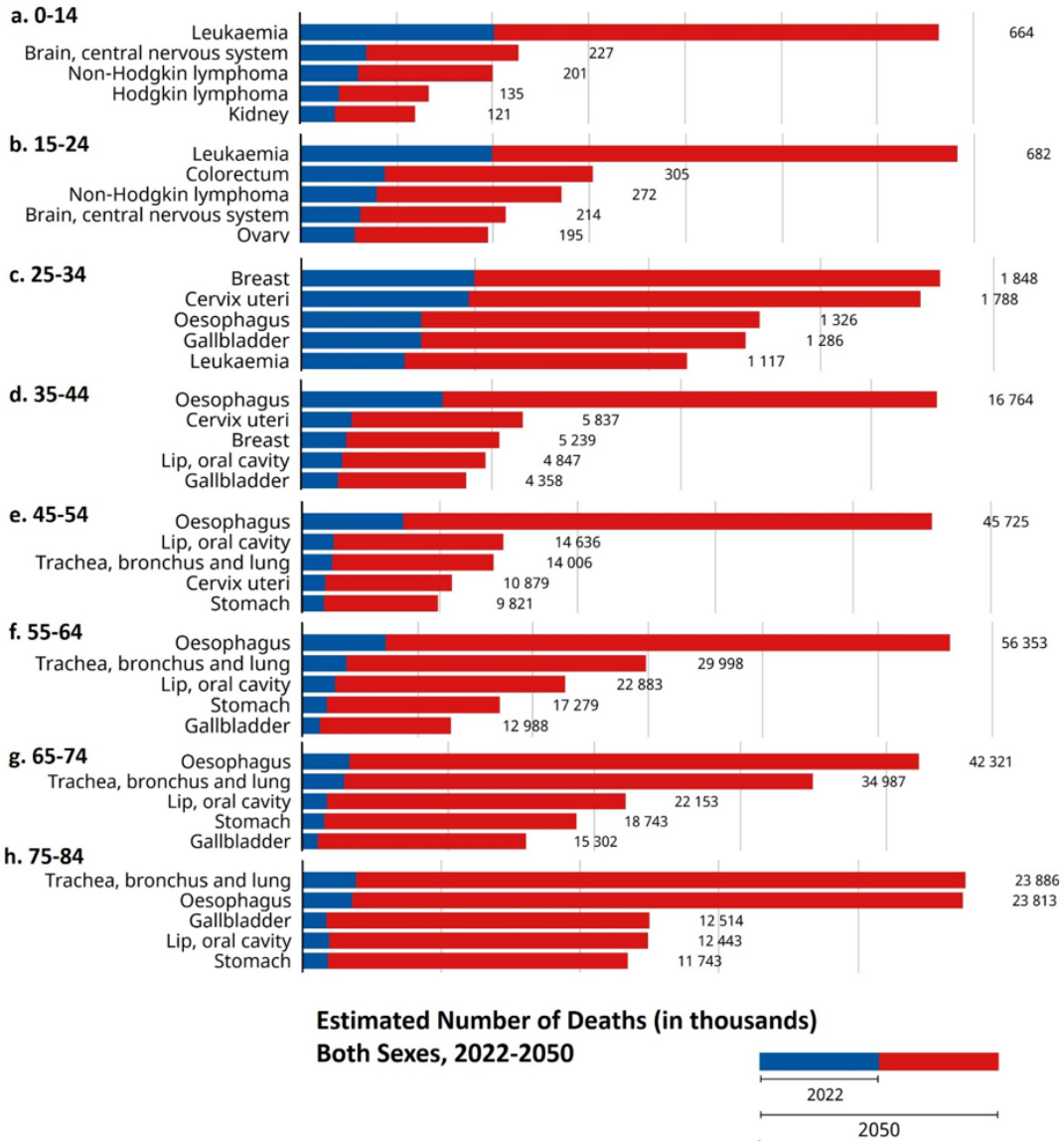

Figure 6. Age Standardized Estimation of Cancers at Top 5 Cancers Site on Particular Range of Ages from 2022 to 2050 for Both Sexes. Blue indicates cancer mortality in 2022 and red indicated estimated death in 2050.

Cancer Forecast up to 2050 in Bangladesh

Future projections of cancer-related mortality in Bangladesh up to the year 2050 indicated significant increases across most cancer types and age groups (Figure 5 & 6). The total estimated number of new cancer cases in 2050 is projected to reach 348,000, an increase of 181,000 compared to current figures. Similarly, cancer-related deaths are expected to rise to 252,000, reflecting an actual increase of 153,000. A notable upward trend is projected for nearly all cancer types, with the most substantial increases observed in esophageal, lip and oral cavity, trachea, bronchus and lung, breast, and gallbladder cancers. In terms of mortality, the most dramatic rise is expected in trachea, bronchus, and lung cancers, with an 830.3% increase, followed closely by an 811.7% rise in gallbladder cancer-related deaths.

Esophageal cancer is anticipated to remain the leading cause of cancer-related deaths by 2050, followed by trachea, bronchus and lung, and lip and oral cavity cancers. Among children aged 0–14 years, leukemia is estimated to cause the highest number of deaths (664), followed by brain and central nervous system (CNS) cancers (227), and non-Hodgkin lymphoma (201) in 2050.

In the 15–24 years age group, colorectal cancer is projected to be a notable cause of death, with an estimated 305 fatalities. Among females, breast cancer and cervical cancer are expected to result in 1,848 and 1,788 deaths, respectively. Gallbladder cancer is forecasted to be a significant cause of mortality, particularly in the 25-44- and 55-84-years age groups. Esophageal cancer is projected to have the highest death toll, with an estimated 56,353 deaths among individuals aged 55-64 years, followed by 45,725 deaths in the 45-54 years' age group.

Lung cancer is anticipated to become the leading cause of cancer-related deaths in individuals aged 75–84 years. Additionally, cancers of the gallbladder, lip and oral cavity, and stomach are estimated to rank as the third, fourth, and fifth most common causes of cancer-related deaths in older adults, respectively.

Discussion

This study examined the age- and sex-specific incidence of 32 cancer types in the Bangladeshi population in 2022, along with projections for 2050. Significant disparities in cancer burden were observed by cancer type, prevalence, site, age group, age-standardized incidence rate (ASIR), and age-standardized mortality rate (ASMR). Cancer prevalence was found to be higher in males than in females. Similarly, both ASIR and ASMR were higher in males. The risk of dying from cancer before the age of 75 was also observed to be greater in males compared to females. Given the high prevalence and elevated risk, there is an urgent need for early diagnosis and the implementation of the most effective treatment strategies for cancer.

This study adds valuable insights to the cancer statistics of the Bangladeshi population, where sex-specific cancer screening programs remain limited, particularly for men. Men in Bangladesh are disproportionately affected by occupational and other modifiable cancer risk factors, contributing to higher cancer incidence and poorer outcomes compared to women [15, 16]. While female-specific cancer screening and prevention programs such as those for breast and cervical cancers are in place and contribute to reduced mortality, comparable male-specific screening initiatives are largely absent [17].

A meaningful regional comparison indicates that Bangladesh's cancer profile broadly aligns with trends observed across South Asia, while exhibiting important distinctions. Jain et al. [18] reported that esophageal and oral cancers dominate in SAARC countries, consistent with the current findings for Bangladesh; however, lung and colorectal cancers were more prominent in India and Pakistan. The GBD 2019 Cancer Collaborators [19] demonstrated rising trends in gastrointestinal and lung cancers across Asia between 1990 and 2019, aligning with our projected increases, although gallbladder cancer showed comparatively slower regional growth than observed in Bangladesh. Furthermore, Islam et al. [20] highlighted systemic challenges in Bangladesh, including inadequate oncology infrastructure and late-stage diagnoses, which help explain persistently high mortality despite moderate incidence. These consistencies likely reflect shared lifestyle and environmental risk factors such as tobacco and betel nut consumption across South Asia, whereas differences may stem from variations in dietary patterns, pollution exposure, healthcare access, and early detection capacity. Collectively, these comparisons underscore Bangladesh's particular vulnerability to esophageal and gallbladder cancers and emphasize the need for context-specific prevention, early detection, and health system strengthening strategies.

In Bangladesh, the primary burden of earning typically falls on males, while females are traditionally responsible for family management, child-rearing, and household tasks. Given the socioeconomic structure, managing expenses and household responsibilities with a single income is increasingly challenging, often leading to considerable stress among males. Consequently, many men resort to smoking as a coping mechanism for stress and emotional strain [21]. Due to the highly addictive nature of nicotine, quitting smoking, whether partially or completely, proves difficult. Additionally, the widespread availability and affordability of tobacco products in Bangladesh supported by an extensive network of grocery shops and minimal restrictions on marketing further aggravate the problem [22].

Older men, particularly retirees aged above 60 or 65 years, exhibit a high dependency on tobacco consumption, largely attributed to loneliness and a surplus of idle time. Chronic tobacco use remains a major modifiable risk factor for cancers affecting the lungs, respiratory tract, and oral cavity in Bangladeshi males [23, 24]. Our findings align with national data showing that 75.8% of male cancer patients had a history of smoking [24].

Among females, betel leaf chewing mixed with tobacco is common, significantly increasing the risk of oral and cavity cancers [11]. Breast cancer and gallbladder (GB) cancer have emerged as alarming public health concerns among women in Bangladesh [25]. Religious and cultural barriers often hinder discussions of cancer symptoms and abnormalities in school and college education [26]. Moreover, the lack of widespread awareness programs has left many women uninformed about early signs of cancer [27]. The shortage of female oncologists specializing in breast cancer further discourages women from seeking timely medical consultations due to shyness and reluctance, exacerbating late diagnosis and poor outcomes.

Gallbladder cancer, in particular, has gained prominence as a significant cause of mortality among Bangladeshi females. Gallstones, driven by hormonal factors such as elevated estrogen levels, act as a major precursor to gallbladder cancer [28]. The habitual consumption of spicy and pickled foods, common dietary patterns among Bangladeshi women, may contribute further to this risk. Additionally, women above the age of 50, undergoing menopause-related hormonal changes, are at greater risk of developing GB cancer [29].

Our study also corroborates previous national data showing that 46% of all cancer patients have a history of tobacco use, with a worrying trend of rising smoking rates among young females in urban areas like Dhaka [24]. Besides tobacco and betel nut consumption, other important risk factors include hypertension, ischemic heart disease, stroke, kidney diseases, and poor dietary habits such as low fruit and vegetable intake, and high consumption of hot beverages and spicy foods which collectively contribute to the rising incidence of esophageal cancer [30].

Environmental factors such as water and air pollution laden with carcinogens further amplify the cancer risk, particularly in densely populated areas like Dhaka. Unfortunately, Bangladesh lacks a robust, population-based cancer registry system, making it challenging to accurately assess cancer statistics nationwide [3].

Between 2022 and 2050, cancer cases and deaths in Bangladesh are projected to more than double, highlighting increasing disparities in the cancer burden. Mortality was found to be higher among older age groups compared to younger ones. Among the top five cancers

prevalent in Bangladesh, esophageal cancer remained the leading cause of mortality followed by lung, breast, cervix uteri and lip and oral cavity. However, at the older age, lung cancer becomes the leading cause of death. A significant finding was the gallbladder cancer which was significantly higher in female considering age groups. Rare cancers, including thyroid, testicular, and vaginal cancers, showed a considerable amount of mortality and created national burden. Future projections of cancer-related mortality in Bangladesh up to the year 2050 indicate significant increases across most cancer types and age groups.

Improving cancer outcomes in Bangladesh and preparing for the projected rise in cancer burden by 2050 requires strengthening health infrastructure, access, and service quality through a coordinated, multi-sectoral approach and robust national and international collaboration [31–35]. A well-trained and sufficient global health workforce is critical to reducing cancer disparities. Key strategies include expanding publicly funded medical schools and scholarships, offering continuous education and specialization opportunities, ensuring equitable geographic distribution of healthcare professionals, and improving staff retention [34]. Equitable implementation of the Sustainable Development Goals especially Target 3.c, which focuses on training health workers can significantly enhance cancer outcomes. Furthermore, it is essential to equip health systems with adequate diagnostic infrastructure (e.g., medical laboratories, pathology services) and treatment facilities (e.g., radiation therapy), ensuring affordability, cost-effectiveness, and optimal use of existing resources [34].

Another strategy to reduce disparities and improve cancer outcomes could be to expand health coverage, which could strengthen efforts to provide basic cancer care options. However, there is currently low health coverage in developing countries like Bangladesh, which were disproportionately affected by poor cancer outcomes in this study. It is crucial to expand the universal health strategies and lessons to Bangladesh. The higher mortality observed among older adults and individuals with rare or less common cancer types suggests a potential need for targeted interventions [32]. Although cancer-related mortality increases with age, a significant proportion of premature deaths in older adults may also result from limited access to healthcare services. Contributing factors include financial barriers, lower participation in preventive health activities, a preference for maintaining quality of life over prolonging it, and gaps in evidence-based care due to the underrepresentation of older adults in clinical trials used to develop cancer treatment guidelines.

Therefore, improving access to cancer prevention and care along with advancing targeted research to identify effective, affordable, and acceptable options for prevention, screening, diagnosis, and treatment could lead to better outcomes for older populations and those affected by rare cancer types.

As mentioned earlier, caution should be exercised when interpreting findings across age groups, as some cancers are more prevalent in younger individuals (e.g., leukemia and Hodgkin lymphoma), while others are more common in older populations (e.g., lung and bladder cancer) [36, 37]. The disparities in cancer outcomes between developed and developing countries may stem from a variety of factors. These include limited implementation of interventions to address modifiable risk factors (e.g., tobacco and alcohol use), demographic shifts such as population aging, underinvestment in cancer prevention and research, and competing health priorities such as the higher burden of infectious diseases that limit the allocation of resources to cancer control.

Limitations

This study relied exclusively on modeled secondary data from the International Agency for Research on Cancer GLOBOCAN 2022 database rather than primary, population-based cancer registry data. Estimates were derived using assumptions and mortality-to-incidence modeling, which may not fully capture underreporting, regional disparities, or real-time epidemiological variations in Bangladesh.

In conclusion, this study underscores the critical need for the development of comprehensive national cancer control strategies in Bangladesh, guided by detailed analyses of age- and sex-specific cancer burden patterns. The results highlight the urgent need to improve early cancer detection efforts, broaden the availability of diagnostic services, and implement tailored strategies for populations at heightened risk. Prioritizing preventive measures such as vaccination campaigns, anti-tobacco initiatives, and comprehensive public health education will be vital in curbing the growing cancer burden. Strengthening oncology systems, expanding the healthcare workforce, and ensuring equitable access to quality care are critical to meeting the increasing demand. Integrating cancer prevention and control into overarching health system reforms is essential to guarantee that all individuals benefit from timely diagnosis and effective treatment. Without intervention, the national cancer burden may double by 2050. Additionally, continued research into modifiable lifestyle risks and thorough assessments of national screening and prevention programs will play a key role in reducing cancer incidence and mortality rates over the long term in Bangladesh.

Author Contribution Statement

H.H. and K.A.B.: Conceptualization, data curation, formal analysis, investigation, methodology, software, visualization, writing – original draft, and writing – review & editing. M.S.R.C., A.R., S.M., K.K.M., M.G., M.M., K.S.A. and M.M.R. (Md. Masudur Rahman): Investigation, methodology, software, visualization, writing – original draft, and writing – review & editing. and M.M.R. (Md. Mahfujur Rahman): Conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, and writing – review & editing.

Acknowledgements

Data availability

The data that support the findings of this study are publicly available through Global Cancer Research Observatory (GCO). https://gco.iarc.fr/en

Ethical approval

This study involving human subjects was reviewed and approved by the Institutional Ethics Committee of Sylhet Agricultural University, Sylhet, Bangladesh. We used publicly available Global Cancer Observatory (GCO) data, so written informed consent for participation was not required for this study in accordance with national legislation and institutional requirements.

Conflict of interest

The authors declare no competing interests.

References

1. Hossain H, Sayeed SSB, Islam S, Ahmad T, Brishty KA, Chowdhury MSR, et al. Prime Editing, CRISPR-Cas9, and NanoCas Genome Editing for Cancer Treatment. Mol Biotechnol. 2026. https://doi.org/10.1007/s12033-025-01548-9.
2. Hussain SA, Sullivan R. Cancer Control in Bangladesh. Jpn J Clin Oncol. 2013;43(12):1159. https://doi.org/10.1093/JJCO/HYT140.
3. Iqbal J. National Cancer Registries in Bangladesh and Social Determinants of Health: Challenging Cancer Disparities. Cancer Control. 2025;32:10732748251323756. https://doi.org/10.1177/10732748251323757.
4. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021;71(3):209–49. https://doi.org/10.3322/CAAC.21660.
5. Islam MR, Siddiqua SM, Islam R, Hossain A, Al Ayub SB, Islam MS, et al. Lung Cancer in Bangladesh. J Thorac Oncol. 2023;18(8):972–80. https://doi.org/10.1016/j.jtho.2023.05.005.
6. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024;74:229–63. https://doi.org/10.3322/CAAC.21834.
7. World Health Organization. 50-bangladesh-fact-sheet, Globocan 2022 (version 1.1) - 08.02.2024. 2024.
8. Chatsirisupachai K, Lagger C, de Magalhães JP. Age-associated differences in the cancer molecular landscape. Trends Cancer. 2022;8:962–71. https://doi.org/10.1016/J.TRECAN.2022.06.007.
9. Hasan AHMN. Distribution of cancer and patterns of cancer treatment at Dhaka medical college hospital, Bangladesh. 2012.
10. Zhu Y, Shao X, Wang X, Liu L, Liang H. Sex disparities in cancer. Cancer Lett. 2019;466:35–8. https://doi.org/10.1016/J.CANLET.2019.08.017.
11. Uddin AFMK, Mahmud A, Islam J, Khan Z. Cancer care scenario in Bangladesh. South Asian J Cancer. 2013;2:102. https://doi.org/10.4103/2278-330X.110510.
12. Basu P. HPV vaccination and screening for cervical cancer. Reducing Social Inequalities in Cancer: Evidence and Priorities for Research 2019.
13. Estupiñán Fdez. de Mesa M, Marcu A, Ream E, Whitaker KL. Socioeconomic inequities in care experienced by women with breast cancer in England: An intersectional cross-sectional study. Eur J Oncol Nurs. 2024;72:102648. https://doi.org/10.1016/j.ejon.2024.102648.
14. Wild CP, Weiderpass E, Stewart BW. World Cancer Report 2020. Lyon (FR): International Agency for Research on Cancer; 2020. PMID: 39432694.
15. Dai X, Gakidou E, Lopez AD. Evolution of the global smoking epidemic over the past half century: Strengthening the evidence base for policy action. Tob Control. 2022;31:129–37. https://doi.org/10.1136/TOBACCOCONTROL-2021-056535.
16. Carey RN, Reid A, Darcey E, Si S, Fritschi L, Hutchings SJ, et al. The future excess fraction of occupational cancer among those exposed to carcinogens at work in Australia in 2012. Cancer Epidemiol. 2017;47:1–6. https://doi.org/10.1016/j.canep.2016.12.009.
17. Lui PSC, Singh K, Nguyen T, Kurth B, Phan T, Nelson A, et al. Determinants of cancer screenings participation in Queensland: a scoping review. J Prim Health Care. 2024;16:70–7. https://doi.org/10.1071/HC23012.
18. Jain U, Rahim F, Jain B, Komanduri A, Arkalgud A, Sabet CJ, et al. Cancer burden across the South Asian Association for Regional Cooperation in 2022. BMJ Oncol. 2024;3:e000466. https://doi.org/10.1136/bmjonc-2024-000466.
19. Sharma R, Abbastabar H, Abdulah DM, Abidi H, Abolhassani H, Abrehdari-Tafreshi Z, et al. Temporal patterns of cancer burden in Asia, 1990-2019: a systematic examination for the Global Burden of Disease 2019 study. Lancet Reg Health Southeast Asia. 2024;21:100333. https://doi.org/10.1016/j.lansea.2023.100333.
20. Islam MR, Siddiqua SM, Mina S, Al Ayub SB, Islam R, Saha B, et al. Cancer care in Bangladesh: an urgent need for strategic intervention and comprehensive reform. Discov Health Syst. 2025;4:96. https://doi.org/10.1007/s44250-025-00283-x.
21. Imamuzzaman M, Muhammad F, Haque I, Ahmed K, Mukta KF, Reuben RC, et al. Prevalence of Smoking and its Associated Factors among Adolescent Males in Bangladesh: A Community Survey. Open Public Health J. 2022;15:1-7. https://doi.org/10.2174/18749445-V15-E221115-2022-83.
22. Saha J, Sara SS, Ali MH, Razu SR, Kundu S, Haq I, et al. Prevalence and factors associated with tobacco smoking in Bangladesh. Discov Public Health. 2024;21:1–10. https://doi.org/10.1186/S12982-024-00238-2/TABLES/3.
23. Wu F, Chen Y, Parvez F, Segers S, Argos M, Islam T, et al. A Prospective Study of Tobacco Smoking and Mortality in Bangladesh. PLoS One. 2013;8:e58516. https://doi.org/10.1371/JOURNAL.PONE.0058516.
24. The Business Standard. Cancer accounts for 12% of annual deaths in Bangladesh: BSMMU study, 2025. Available from:https://www.tbsnews.net/bangladesh/health/cancer-causes-12-annual-deaths-bangladesh-study-finds-1057671.
25. Rahman MdA, Hossen MM, Chowdhury MdEH, Anu FA, Islam T, Rahman MdS, et al. Psychometric Validation of the Bangla Version of the Breast Cancer Fear Scale Among Female University Students in Bangladesh. Int J Breast Cancer. 2025;2025:6811105. https://doi.org/10.1155/IJBC/6811105.
26. Story HL, Love RR, Salim R, Roberto AJ, Krieger JL, Ginsburg OM. Improving outcomes from breast cancer in a low-income country: lessons from bangladesh. Int J Breast Cancer. 2012;2012:1–9. https://doi.org/10.1155/2012/423562.
27. Yazdi KS, Choudhury M, Chowdhury F, Ahmed SA, Islam

MS. Association of Betel Leaf Chewing and Use of Tobacco with Development of Oral Cancer. J Dhaka Natl Med Coll Hosp. 2015;21:42–7. https://doi.org/10.3329/JDNMCH.V21I1.77835.
28. Liu R, Zhang C, Shen Y, Wang J, Ye J, Yu J, et al. Establishment and validation of a novel prognostic nomogram for gallbladder cancer patients. Eur J Med Res. 2025;30:331. https://doi.org/10.1186/S40001-025-02513-7.
29. Vien P, Sun SH, Melstrom LG. Gallbladder Cancer Epidemiology and Risk Factors. Gallbladder Cancer: A Comprehensive Guide to Management. 2025:25–37.
30. Lander S, Lander E, Gibson MK. Esophageal Cancer: Overview, Risk Factors, and Reasons for the Rise. Curr Gastroenterol Rep. 2023;25:275–9. https://doi.org/10.1007/S11894-023-00899-0.
31. Sedeta E, Sung H, Laversanne M, Bray F, Jemal A. Recent Mortality Patterns and Time Trends for the Major Cancers in 47 Countries Worldwide. Cancer Epidemiol Biomarkers Prev. 2023;32:OF1–12. https://doi.org/10.1158/1055-9965.EPI-22-1133.
32. Gallicchio L, Daee DL, Rotunno M, Barajas R, Fagan S, Carrick DM, et al. Epidemiologic research of rare cancers: Trends, resources, and challenges. Cancer Epidemiol Biomarkers Prev. 2021;30:1305–11. https://doi.org/10.1158/1055-9965.EPI-20-1796.
33. dos-Santos-Silva I, Gupta S, Orem J, Shulman LN. Global disparities in access to cancer care. Commun Med. 2022;2:31. https://doi.org/10.1038/S43856-022-00097-5.
34. Prager GW, Braga S, Bystricky B, Qvortrup C, Criscitiello C, Esin E, et al. Global cancer control: Responding to the growing burden, rising costs and inequalities in access. ESMO Open. 2018;3:e000285. https://doi.org/10.1136/esmoopen-2017-000285.
35. Romero Y, Trapani D, Johnson S, Tittenbrun Z, Given L, Hohman K, et al. National cancer control plans: a global analysis. Lancet Oncol. 2018;19:e546–55. https://doi.org/10.1016/S1470-2045(18)30681-8.
36. McIntosh SA, Alam F, Adams L, Boon IS, Callaghan J, Conti I, et al. Global funding for cancer research between 2016 and 2020: a content analysis of public and philanthropic investments. Lancet Oncol. 2023;24:636–45. https://doi.org/10.1016/S1470-2045(23)00182-1.
37. Kamaraju S, Drope J, Sankaranarayanan R, Shastri S. Cancer Prevention in Low-Resource Countries: An Overview of the Opportunity. Am Soc Clin Oncol Educ Book. 2020;40:72–83. https://doi.org/10.1200/EDBK_280625.