Epidemiology incidence and mortality worldwide common cancers in males and their relationship with the human development index (HDI): An ecological study updated in the world

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This article provides a status report on the global burden of common cancers in male worldwide using the GLOBOCAN 2018 estimates of cancer incidence and mortality.

Based on the results of cancer records in 2018, 9,456,418 cases of malignancy were recorded in males, with lung cancer (1,368,524 cases, 14.5%), prostate cancer (1,276,106 cases, 13.5%), colorectal cancer (1,026,215 cases, 10.9 %), stomach cancer (683,754 cases, 7.2%), and liver cancer (596,574 cases, 6.3%) were the five most common cancers in men worldwide. The total number of deaths due to cancer in humans in 2018 is 5,385,640. The five causes of death due to cancer in men worldwide are lung cancer (1,184,947 cases, 22%), liver (548,375 cases, 2.10%), stomach cancer (513,555 cases, 9.5%), colorectal cancer (484,224 cases, 9%), and prostate cancer (358,989 cases, 7.7%). Our results showed that there was a positive correlation between the incidence of lung cancer (R = 0.629, $P < 0.0001$), prostate cancer (R = 0.534, $P < 0.0001$), colorectal cancer (R = 0.745, $P < 0.0001$), and stomach cancer (R = 0.268, $P < 0.001$) with human development index (HDI) index, while there was no significant relationship between liver cancer and the HDI (R = 0.079, $P > 0.05$). The results also showed that there was a positive and significant correlation between mortality from lung cancer (R = 0.632, $P < 0.0001$) and colorectal cancer (R = 0.627, $P < 0.0001$) with HDI, whereas this correlation was negative for prostate cancer (R = -0.187, $P < 0.01$).

Keywords: Common cancer, incidence, mortality, males, HDI

Introduction

During the last century, there have been serious changes in the incidence of diseases. Reducing the burden of contagious diseases and increasing the incidence, prevalence, and mortality of non-communicable and chronic diseases and incidents are the most significant of these changes.[1–3] This is not the case for developed countries, and developing countries have been dramatically affected by these[4,5] changes. Reports indicate that in the years up to 2015, about 45% of all deaths in the world have been caused by non-communicable diseases. In the meantime, cancer has a 10% share.[6]

Cancer is a multifactorial disease. In various combinations, these can cause cancer. Some of these factors affect the genetic structure of the body, while others cause cancer in people who have genetic infrastructure prone to mutation.[7,8] Some of the risk factors for cancer include: tobacco consumption, infectious agents, alcohol consumption, reproductive factors such as hormones, nutrition, obesity, insufficient mobility, ionizing radiation, sunlight and ultraviolet radiation, electromagnetic waves, occupational exposures, environmental pollution such as fungi and genetic susceptibility.[7,9–11] A descriptive epidemiological survey of cancer can help to better understand the cancer etiology to develop preventive strategies, as well as to plan for health systems, diagnosis, and treatment of the[7,12] disease. It will also be useful to acknowledge the role of cancer in morbidity and mortality. Determining the pattern of different cancer types is the first step in planning and coordinating national cancer control. The purpose of this study is to investigate the epidemiology of common cancers in men and their relationship with the development index in 2018 based on GLOBOCAN 2018 data.

Data Sources and Methods:

Caution must be exercised when interpreting these estimates, given the limited quality and coverage of cancer data worldwide at present, particularly in low- and middle-income countries. IARC's approach is not only to evaluate, compile, and use the data from the Agency's collaborators in these estimates but also to work alongside national staffs to improve local data quality, registry coverage, and analytical capacity. The clear need for investment in population-based cancer registration in low- and middle-income countries led to the launch of the Global Initiative for Cancer Registry Development (GICR), coordinated by IARC. The goal of the GICR is to inform cancer control through defined improvements in the coverage, quality, and use of population-based cancer registration data worldwide. A summary of the steps used to generate the current set of cancer incidence, mortality, and prevalence estimates is provided below. The methods of estimation are country-specific, and the quality of the national estimates depends on the coverage, accuracy, and timeliness of the recorded incidence and mortality data in a given country.

Incidence

The methods used to estimate the sex- and age-specific incidence rates of cancer in a specific country fall into the following

broad categories, in order of priority: (1) Observed national incidence rates were projected to 2018 (45 countries). (2) The most recently observed incidence rates (national or regional) were applied to the 2018 population (50 countries). (3) Rates were estimated from national mortality data by modeling, using mortality-to-incidence ratios derived from cancer registries in that country (14 countries). (4) Rates were estimated from national mortality estimates by modeling, using mortality-to-incidence ratios derived from cancer registries in neighboring countries (37 countries). (5) Age- and sex-specific national incidence rates for all cancers combined were obtained by averaging overall rates from neighboring countries. These rates were then partitioned to obtain the national incidence for specific sites using available cancer-specific relative frequency data (7 countries). (6) Rates were estimated as an average of those from selected neighboring countries (32 countries).

Mortality

The methods used to estimate the sex- and age-specific mortality rates of cancer in a specific country fall into the following broad categories, in order of priority: (1) Observed national mortality rates were projected to 2018 (81 countries). (2) The most recently observed national mortality rates were applied to the 2018 population (20 countries). (3) Rates were estimated from the corresponding national incidence estimates by modeling, using incidence-to-mortality ratios derived from cancer registries in neighboring countries (81 countries). (4) Rates were estimated as an average of those from selected neighboring countries (3 countries).[13–15]

Human Development Index

Human development index (HDI) is a compound index of indices in three dimensions: life expectancy, degree of studies, and dominance over required sources for a proper sensible life. All the groups and regions which have had a remarkable progress in all HDI components have developed more rapidly in comparison with low or moderate HDI countries. As this index says, the world is unequal because national average hides most of the different experiences in human's life. There exist a lot of inequalities in northern and southern countries. Income inequality has risen inside every country and also between many countries.[16–19]

Results

Distribution of Cases and Deaths by World Region and Cancer Type

Based on the results of cancer records in 2018, 18,078,957 cases of cancer were recorded in both sexes, of which 9,456,418 cases were in males. The results showed that lung cancer (1,368,524 cases, 14.5%), prostate cancer (1,276,106 cases, 5.13%), colorectal cancer (CRC) (1,026,215 cases 9.10%), stomach cancer (683,754 cases 2.7%), and liver cancer (596,574 cases 6.6%) are the five most common cancers in men worldwide. The total number of deaths due to cancer in 2018 was 9,555,027, of which 5,385,640 cases were men. The results showed that five causes of death due to cancer in men worldwide were related to pulmonary cancers (1,184,947, 22%), liver (548,375 cases, 2.10%), stomach (513,555 cases, 9.5%), colorectal (484,224 cases, 9%), and prostate (358,989 cases, 7.7%) (Fig. 1). Figure 2 shows the most common cancer and the most common cause of death due to cancer in each country (Fig. 2).

Cancer Incidence and Death Rates by World Region

The results showed that approximately half of the cancers in men (4,656,551 cases, 49.2%) were in Asia, followed by Europe (2,247,518 cases, 23.8%), and North America (1,274,306 cases, 13.5%). Of the total deaths due to cancer in men, 3,231,463 (60%) are in Asia, 1,085,592 (20.2%) in Europe, and 367,738 (6.8%) in North America (Fig. 3).

Cancer Incidence and Death Rates by World Region

The results showed that the highest incidence rates in the different regions of the world was related to Australia and New Zealand (527.500 in 100,000), North America (387/100,000),
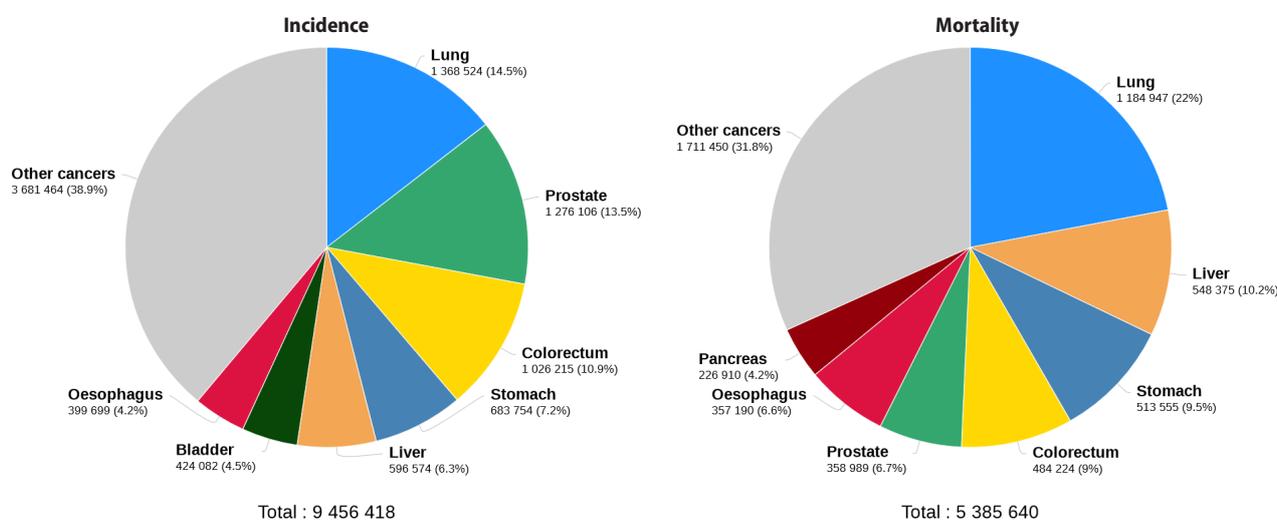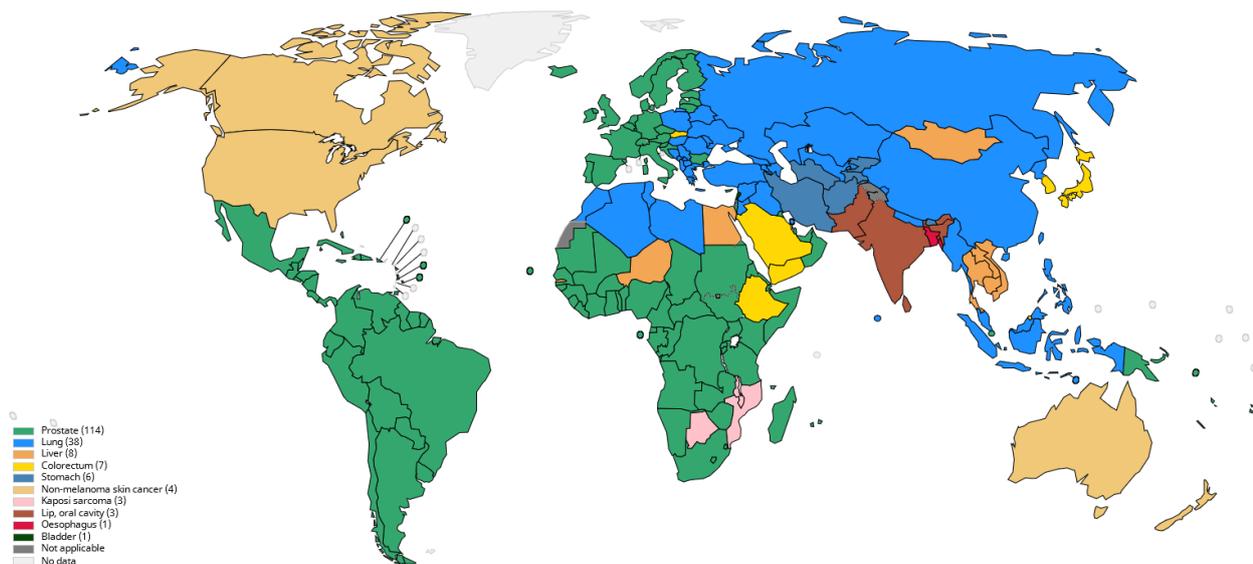

Fig. 1 **Pie charts present the distribution of cases and deaths for the seven most common cancers for males in 2018 in worldwide among all ages.**
[Source: GLOBOCAN 2018].

A) Incidence Rate
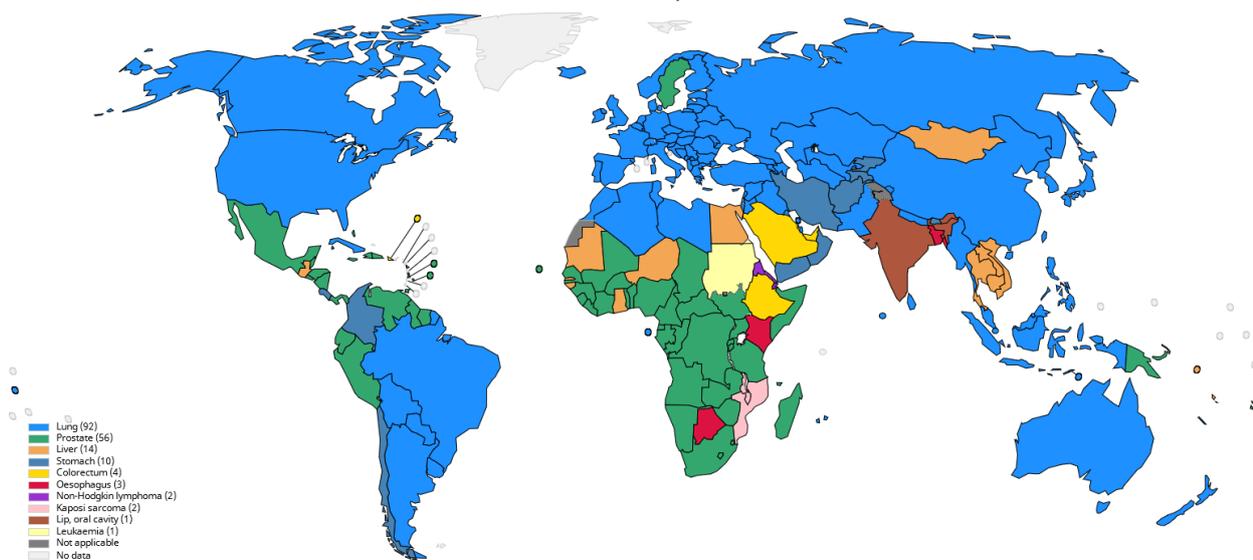Top cancer per country, estimated age-standardized incidence rates (World) in 2018, males, all ages

Prostate (114)
Lung (38)
Liver (8)
Colorectum (7)
Stomach (6)
Non-melanoma skin cancer (4)
Kaposi sarcoma (3)
Lip, oral cavity (3)
Oesophagus (1)
Bladder (1)
Not applicable
No data

Data source: GLOBOCAN 2018
Graph production: IARC
(http://gco.iarc.fr/today)
World Health Organization

World Health Organization
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B) Mortality Rate

Lung (92)
Prostate (56)
Liver (14)
Stomach (10)
Colorectum (4)
Oesophagus (3)
Non-Hodgkin lymphoma (2)
Kaposi sarcoma (2)
Lip, oral cavity (1)
Leukaemia (1)
Not applicable
No data

Data source: GLOBOCAN 2018
Graph production: IARC
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Fig. 2 **Global map presenting top cancer country, age-standardized (A) Incidence and (B) Mortality rates by world countries in males for all cancers among all ages in 2018.**
Source: GLOBOCAN 2018.

and Western Europe (363/100,000), with the highest mortality rates related to Central and Eastern Europe (171 per 100,000), Eastern Asia (159.6 per 100,000), and Southern Africa (14.4 per 100,000) (Fig. 4).

Cancer Incidence and Mortality Patterns by the 4-tier HDI

In low/medium HDI areas, the highest incidence of malignancy in men was related to lung cancer (11.8/100,000), prostate cancer (11.4/100,000), and lip, oral cavity (8.7/100,000), while lung cancer (40.4 per 100,000), prostate (37.4 per 100,000), and colorectal (30.5 per 100,000) had the highest incidence in high/very high HDI areas (Fig. 5).

Lung Cancer

Lung cancer is still the deadliest and most costly cancer in the world, and its mortality rate is three times more than deaths from prostate cancer and nearly twice as high as deaths from
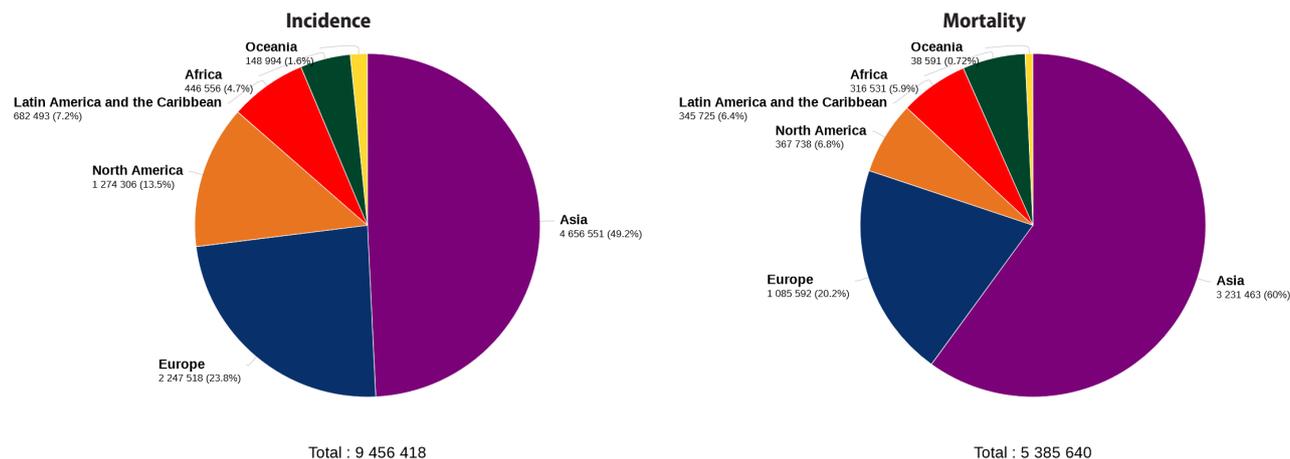
Incidence

Oceania
148 994 (1.6%)

Africa
446 556 (4.7%)

Latin America and the Caribbean
682 493 (7.2%)

North America
1 274 306 (13.5%)

Europe
2 247 518 (23.8%)

Asia
4 656 551 (49.2%)

Total : 9 456 418

Mortality

Oceania
38 591 (0.72%)

Africa
316 531 (5.9%)

Latin America and the Caribbean
345 725 (6.4%)

North America
367 738 (6.8%)

Europe
1 085 592 (20.2%)

Asia
3 231 463 (60%)

Total : 5 385 640

Fig. 3 **Pie charts present the distribution of cases and deaths by continent in 2018 for males among all ages.**
Source: GLOBOCAN 2018.

Region	Mortality	Incidence
South America	107.3	220
Southern Africa	142.4	230.5
Eastern Asia	159.6	238.4
Polynesia	142.2	241.7
Central and Eastern Europe	171	280.1
Southern Europe	131.5	319.5
Northern Europe	118.4	344.6
Western Europe	130	363.5
North America	104.2	387.6
Australia and New Zealand	109.8	571.2

ASR (World) per 100000
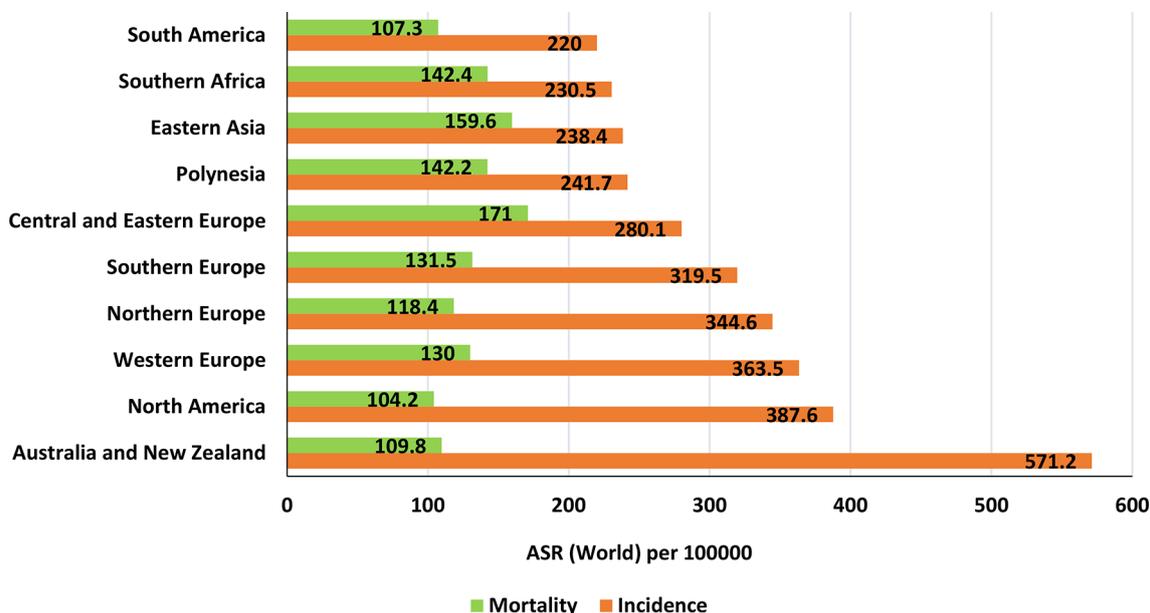
■ Mortality ■ Incidence

Fig. 4 **Bar chart of region-specific incidence and mortality age-standardized rates by world area for males (all cancers) in 2018.**
Source: GLOBOCAN 2018.

breast cancer in women. Lung cancer currently accounts for 32% of men's cancer deaths and 20% of deaths from cancer in women. Today, the incidence of this cancer has a significant reduction in men (from 87 to 63 per 100,000 people), while its rate in women (from 4.1 to 9.9 per 100,000 people) has shown a dramatic increase. According to various studies, the incidence of lung cancer in developed countries is 1.5–2.3 times higher than that of the less developed countries in any age group. Lung cancer is affected by many factors such as environmental and behavioral factors, one of the most important of which is smoking cigarettes. The risk of lung cancer in smokers is 20 times higher than non-smokers. More than 80% of the lung cancer in the western population is attributed to smoking, which can be prevented through tobacco control.

According to cancer results recorded in 2018, lung cancer has the highest incidence and mortality among the world's cancers in both sexes with 2,093,876 new cases (with 12.22 per

100,000) and 176,1007 deaths (19.88 per 100,000). The highest incidence of lung cancer according to world areas in men was Micronesia (54.1 per 100,000), Polynesia (52 per 100,000), and Central and Eastern Europe (49.3 per 100,000), with the highest mortality rate for Micronesia (7.51 at 100,000), Central and Eastern Europe (44/100000), and Polynesia (2.43 at 100,000) (Fig. 6). According to cancer records in 2018, Hungary (77.4 per 100,000), Serbia (71.6 per 100,000), and Turkey (70.6 per 100,000) have the highest incidence of lung cancer in men (Table 1, Fig. 7). Studies show that the number of deaths from lung cancer in most developed countries is mainly due to the aging population and, in the less developed countries, the gradual increase in the use of cigarettes and tobacco by control of which, mortality rates could be reduced.

According to the results of 2018, the highest mortality rates for lung cancer were in Turkey (68.6% in 100,000), Hungary (62.9% in 100,000), and Serbia (61.1 in 100,000) (Table 2).

Elham Goodarzi et al.

High/Very high HDI

	Mortality	Incidence
Leukaemia	4.5	7.4
Non-Hodgkin lymphoma	3.2	7.8
Kidney	3.2	8.1
Oesophagus	9.5	11
Bladder	3.6	12.1
Liver	15	16.8
Stomach	14.2	20
Colorectum	12.9	30.5
Prostate	8	37.4
Lung	34.1	40.4

Low/Medium HDI

	Mortality	Incidence
Bladder	2	3.6
Leukaemia	3.2	4
Non-Hodgkin lymphoma	3.2	4.3
Oesophagus	5.2	5.5
Stomach	5.9	6.6
Colorectum	5.7	8.4
Liver	8.3	8.5
Lip, oral cavity	5	8.7
Prostate	6.3	11.4
Lung	11	11.8

Fig. 5 **Bar charts of incidence and mortality age-standardized rates in high/very-high human development index regions versus low/ medium human development index regions.**
Source: GLOBOCAN 2018

Lung

Region	Incidence	Mortality
Micronesia	54.1	51.7
Polynesia	52	43.2
Central and Eastern Europe	49.3	44.2
Eastern Asia	47.2	41.1
Western Europe	43.3	33.5
Southern Europe	43.1	36.1
North America	39.1	25.8
Western Asia	38.8	37.6
Northern Europe	34	25.1
Australia and New Zealand	28.4	20
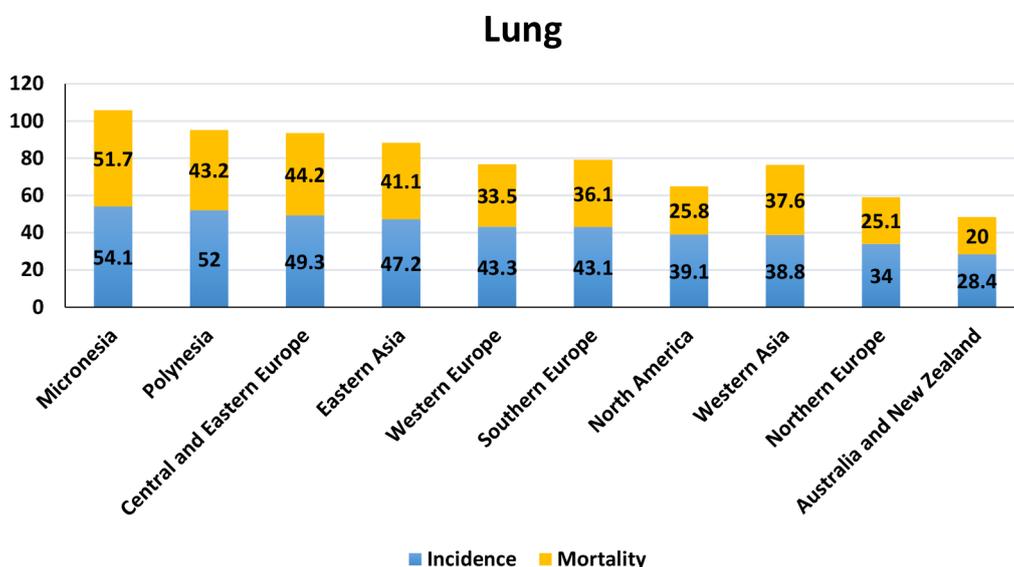
Fig. 6 **Bar chart of region-specific incidence and mortality age-standardized rates for lung cancer in 2018. Rates are shown in descending order of the world (W) age-standardized rate.**
Source: GLOBOCAN 2018.

Prostate Cancer

According to 2012 statistics, prostate cancer accounts for 15% of men's cancers and the second leading cause of cancer death in men (after lung cancer). The average age of diagnosis of prostate cancer is 72 years. It can be said that there is a direct relationship between the age and incidence of prostate cancer. Nearly three-quarters of the cases of prostate cancer diagnosed in the world occur in men over 65 years of age.

Although prostate cancer is widely reported across the world, its prevalence is more common in southern and eastern Asia, Europe, North America, Australia, and New Zealand.

Table 1. **Incidence rates (age-standardized rate) for the five most common Cancers in males in world (2018)**

Site	Age-standardized incidence rates									
	Lung		Prostate		Colorectum		Stomach		Liver	
	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR
Afghanistan	4	9.4	1.6	4.5	2.6	4.7	4.6	11.5	2.1	4.9
Albania	64.7	37.8	44.5	22.9	15.2	9.6	31.2	19.1	17.9	10
Algeria	15.4	17.4	12.2	13	13.7	14.8	6.5	7.1	1.5	1.6
Angola	1.6	4.2	13.4	41	2.5	6	1.4	3.5	2.5	5.2
Argentina	32.5	26.3	53	42.4	39	31.5	11.6	9.4	6.2	5
Armenia	82.2	58.5	46.1	34.2	26.6	18.4	25.5	17	19.1	13.5
Australia	58.7	29.2	148.1	85.6	78.1	41.9	12.5	6.5	14	8.6
Austria	68.5	33.2	130.4	61.6	58.9	26.3	17.1	7.4	17.5	8.2
Azerbaijan	24.8	25.5	5.8	6.7	13.5	13.8	18.8	19.8	3.9	4.1
Bahamas	12.8	10.4	102.3	85.8	30.7	26.4	8.2	6.9	5.1	3.9
Bahrain	5.8	16.3	3.9	10.8	7.3	14.2	1.6	3.5	2	3.9
Bangladesh	11	14.1	2.7	3.4	3.8	4.3	5.7	7	2.8	3.3
Barbados	22.6	13.7	220.4	129.3	86.1	50.3	13.1	7.2	5.1	3
Belarus	82.5	54.5	76.6	49.4	63.7	41.6	38.2	25.1	7.2	4.9
Belgium	109.4	52.2	132.6	65.5	92.7	43.8	17.8	8.4	11.2	5.9
Belize	10	15.7	36.3	55.9	5.8	9.2	6.3	8.8	7.4	12.2
Benin	0.54	0.94	22.9	55.7	4.8	9.5	4.8	10.6	4.1	9.8
Bhutan	5.5	7.1	0.69	1	5.3	6	18.9	24.2	6.5	7.8
Bolivia, Plurinational State of	10	10.3	29	34.2	5.5	6.7	8.3	9.3	5.4	5.6
Bosnia and Herzegovina	111.9	62.4	54.4	26.3	60.8	33	25.9	14	17.1	9.1
Botswana	3.5	6.4	6.2	13.7	3	4.9	0.61	1	3.5	6.4
Brazil	18.5	16.4	82	74	23.9	21.1	11.9	10.6	7.1	6.3
Brunei	25.1	34.4	15.2	22.5	37.6	43.4	13.4	17.9	14.3	17
Bulgaria	98.2	50.1	124.4	53.6	79.6	38.3	25	12	11	5.7
Burkina Faso	1.7	4.6	7	26.5	2.5	5.5	3.7	9.2	8	19.2
Burundi	1.1	2.6	13.7	35.5	3.5	7.7	1.9	4.6	4.9	9
Cabo Verde	9.4	16.3	33	51.4	3.3	7.3	17.4	25.1	8.7	11.3
Cambodia	12.8	21.6	2.4	4.5	8	13	3.1	5	21.3	34.6
Cameroon	1.4	3	17.9	41.6	3.6	7.7	1.6	3.3	5.9	9.3
Canada	68.1	31.1	116.8	58.2	71.1	35.2	10.9	5.2	14.2	7.6
Central African Republic	1.5	3	14.1	30.2	3.3	6.5	1.7	3.3	4.5	7.5
Chad	0.81	2	7.5	22	2.8	6.6	1.4	3.5	3.6	7.8
Chile	24	17	72.9	51.2	33.3	23.9	38	26.9	9.7	6.9
China	70.8	47.8	13.6	9.1	41.5	28.1	43.6	29.5	40	27.6
Colombia	13.4	12.7	52.3	49.8	18.1	16.9	18.8	17.6	4.9	4.6
Comoros	0.24	0.38	12.6	30.3	1.9	4.1	1.2	2.5	4.3	7.6
Congo, Democratic Republic of	1.5	3.9	13.6	35.1	3.9	9	3.8	7.3	5.8	11.5
Congo, Republic of	1.6	3.4	18.7	40.7	3	5.7	1.9	3.7	5.4	8.6

Elham Goodarzi et al.

| Site | Age-standardized incidence rates | | | | | | | | | |
| | Lung | | Prostate | | Colorectum | | Stomach | | Liver | |
	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR
Costa Rica	12.5	9.5	73.9	57.7	22.6	17.6	22.4	17.2	10	7.9
Croatia	105.7	50.9	116.8	54.5	97.2	45.9	25.1	11.8	20.4	9.9
Cuba	72.2	38.7	91.7	48.6	31.5	16.1	12.9	6.9	8.7	4.7
Cyprus	66.4	41	126.2	73.9	56.8	34.4	11.3	7.1	8.6	5
Czech Republic	80.5	38.5	176.5	88	86.9	42.5	15.4	7.4	13	6.1
Côte d'Ivoire	1.6	3.4	19.7	43.7	2.6	4.9	1.6	3.1	5.6	9.7
Denmark	84.7	37.3	163	75.9	103.6	45.9	12.9	6	14.9	7.3
Djibouti	2.1	3	4.5	7.6	4.1	5.8	1.8	2.7	2.3	3.1
Dominican Republic	14.2	14.6	58.1	60.1	13.5	13.9	7.7	8	7.4	7.6
Ecuador	7.2	7	39.4	38.8	10.7	10.8	16.2	15.7	5.7	5.7
Egypt	8.5	11.6	6.2	9.5	5.3	6.6	2.4	3.1	36.8	49
El Salvador	7.1	6.4	47.6	43	8.9	8.9	13.1	11.9	6.9	6.4
Equatorial Guinea	2.7	6.4	13.3	35.9	3.3	6.4	1.4	3.1	4.7	6
Eritrea	1.6	3.3	3.6	7.7	3.7	7	1.5	3	1.9	3.7
Estonia	95.1	51.4	203.8	109.9	67.9	34.8	34.1	18.7	10	5.1
Ethiopia	2	3.8	3.2	6.5	4.1	7.8	1.5	3	1.4	2.6
Fiji	7.3	8	42.6	45	9.3	11.3	4.3	4.5	11.5	12.3
Finland	59.7	24.8	170.4	71.6	66.8	28.7	12.4	5.3	12.7	5.2
France	100.4	51.3	202.5	99	80.5	36.9	15.7	7.2	26.1	13.3
France, Guadeloupe	26	13	384.1	189.1	42.8	21.2	35.6	16.1	10.6	6.2
France, La Réunion	51.7	34.6	95.9	63.7	43.5	29.2	21.7	14.4	13.6	9.1
France, Martinique	30.3	12.3	329.6	158.4	63.4	29	32.6	13.1	14.3	5.9
France, New Caledonia	78.8	59.9	120.7	93	41.9	31.7	19.2	14.4	17.7	14.3
French Guyana	22.1	27.2	73.2	92.3	22.1	26.8	15.9	19.6	12.4	15.5
French Polynesia	64.6	55.7	83.2	73.7	18.6	15.9	11.7	10.1	15.8	13.4
Gabon	6.9	10.9	18.1	31	4.4	6.3	2.2	3.7	3.3	3.9
The Gambia	2.7	6.2	3.1	8.4	0.84	1.7	0.93	2.3	22.9	36.5
Gaza Strip and West Bank	12.1	26.7	7.5	18.1	10.2	21.1	2.9	6	1.2	2.4
Georgia	55.8	35.7	33.5	20.8	17.7	11.1	20.3	12.7	12.6	8.3
Germany	97.9	41	154.5	63.2	76.5	31	22.5	9.4	15.3	6.4
Ghana	0.99	1.8	14.5	32.3	4.5	9.6	3	5.7	13.7	24.4
Greece	143.4	67.8	117.8	50.5	75.8	32.3	21.1	8.9	20.4	8.6
Guam	68	53.7	53.6	42.3	25	20.1	9.5	7	29.8	24.5
Guatemala	2.6	3.9	25.2	39.9	4.3	6.3	9.6	14.7	10.1	15.8
Guinea	2.1	3.7	13.8	35.3	1.2	2.1	3	5.8	14.8	27.9
Guinea-Bissau	1.3	2.6	8.3	21.9	3.2	7.1	3.5	7.8	8.9	17.3
Guyana	3.5	5	29.6	39.3	3.8	4.4	2.5	3.7	2.5	2.7
Haiti	4	6	36.4	55.4	7.4	9.9	11	15.6	6.4	9.5

(Continued)

Table 1. **Continued**

Site	Age-standardized incidence rates									
	Lung		Prostate		Colorectum		Stomach		Liver	
	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR
Honduras	4.6	6.8	16.1	24.9	6.1	9	8.6	12.7	6.4	9.2
Hungary	140.3	77.4	119.5	60.2	132.6	70.6	26.6	13.8	16.7	9.2
Iceland	47.8	27.7	104.4	58.3	54.3	30.5	8.8	4.2	7.1	4.1
India	6.9	7.8	3.7	4.4	5.2	5.8	5.5	6.2	2.7	3.1
Indonesia	16.7	19.4	8.5	11.3	14.2	16.2	1.7	2.1	10.6	12.4
Iran, Islamic Republic of	11.4	12.5	14.6	16.6	13.7	14.6	19.6	21.6	4.8	5.3
Iraq	7.9	17.4	2.8	6.6	3.8	7.2	2.3	4.6	1.4	3.1
Ireland	68.6	38.8	208.8	132.5	73.5	42.4	18.2	10.3	11.5	6.8
Israel	36.9	27.8	69.7	52.2	31.8	22.8	10.3	7.3	4.8	3.5
Italy	93.1	34.5	151.6	61.3	93.1	36	26.7	9.7	30.2	12.8
Jamaica	27.3	21.1	90.8	71.9	26.4	21.3	12.6	10.2	3.8	3
Japan	127.9	41.4	113.8	35.4	133.1	49.1	123.8	40.7	37.8	12.3
Jordan	19	32	7.9	14.7	9.2	14.8	5	8.5	2	3.4
Kazakhstan	39.6	43.8	10.6	12.8	15.6	17.7	22.1	24.7	7.3	8.2
Kenya	1.5	3.6	11.3	30.9	4.5	10	4.1	10	3	6.2
Korea, Democratic Republic of	54.7	48.1	3.5	3.5	26.1	22.7	26.3	23.1	30.6	25.4
Korea, Republic of	75.2	41.7	64.8	36.2	102.1	59.5	99.5	57.8	47.6	27.7
Kuwait	4.6	8.7	9.2	21.6	8.1	12.9	1.8	3	3.7	6.2
Kyrgyzstan	17.6	26.8	4.3	7.5	5.7	8.1	19.9	29.3	8.8	13
Lao People's Democratic Republic	18.1	29.4	2	3.8	9.4	14.9	10.4	16.2	20.5	33.4
Latvia	98	51.8	155.7	80.3	82.9	42.6	35	19	7.1	3.8
Lebanon	37.1	31.3	49.2	39.3	25.4	20.8	9.9	8.2	4.4	3.6
Lesotho	3.2	6.4	12.6	25	2.5	4.4	0.27	0.7	3.7	6.6
Liberia	1.8	3.7	15.3	39.1	1.8	3.4	2.3	4.7	10.1	18.9
Libya	18.2	26.4	9.7	15.6	9.5	13	3.4	4.8	3	4.4
Lithuania	95.6	52.6	117.2	70.2	67.8	35.6	36.6	19.9	12.1	6.5
Luxembourg	72.1	40	134.1	78.8	57.3	31.4	15.8	8.1	16.2	9.1
Madagascar	0.7	1.4	13.4	31.7	2.8	5.5	1.4	2.8	4.5	8.3
Malawi	0.87	2.4	5.5	15.3	1.8	3.9	1.2	3	1.8	2.4
Malaysia	20.7	22.5	10.9	12.4	20.2	22	5.3	5.8	8.8	9.5
Maldives	12.7	18.9	5.9	10.4	11.9	15.9	0	0	8.7	12.3
Mali	1.9	5.5	5.6	17.7	4	9	5.2	12.4	4.6	10.2
Malta	65.9	28.2	135	57.4	82.9	36	19.4	8.4	6.9	3.5
Mauritania	1.9	3.9	8.8	21.9	3.1	5.2	3.5	6.9	9.7	16.8
Mauritius	25	17.7	28.2	19.9	24.9	17.4	12.6	8.9	5.7	4
Mexico	7	7.3	38.5	41.6	12	12.5	6	6.2	5.3	5.5
Mongolia	23.8	36.8	2.2	3.9	4.3	6.5	33.8	47.2	84.2	117
Montenegro	101.5	62.9	63.4	34	37	22.7	11.3	6.8	10.6	5.7
Morocco	32.3	31.9	22.3	22.7	12.3	12.2	6.2	6.2	1.4	1.4

Site	Lung		Prostate		Colorectum		Stomach		Liver	
	Crud Rate	**ASR**	**Crud Rate**	**ASR**	**Crud Rate**	**ASR**	**Crud Rate**	**ASR**	**Crud Rate**	**ASR**
Mozambique	0.86	1.9	11.1	27.1	1.9	3.7	0.78	1.8	4.5	8.8
Myanmar	16.7	19.5	3.1	4	9.9	11.1	15.5	17.6	13.4	14.6
Namibia	2.9	5.6	16.4	37.3	4	7.3	1.6	3.2	2.5	4.2
Nepal	11.8	14.8	0.87	1.1	3.6	4.4	6.2	7.8	1.2	1.5
New Zealand	47.4	24.2	163.7	90.8	77.1	40.2	10.9	5.9	16.5	10
Nicaragua	6	7.7	34.4	45.4	8.1	10.2	10.4	13.5	10.4	13.6
Niger	0.33	0.89	1.5	4.4	2.7	5.5	1.8	4	5.2	11.5
Nigeria	0.78	1.6	13.2	32.8	3.6	6.8	1.6	3.3	3.1	5.9
Norway	62.2	30.9	202.6	106.5	93.6	46.9	12.1	6	9.2	5.3
Oman	3	7.1	4.5	12.7	8.2	11.7	4.9	10.9	2.8	5.8
Pakistan	7.7	11.5	4.4	6.7	3.5	4.5	2.3	3.3	2.6	3.8
Panama	11.6	10.4	65.7	60.7	20.2	18.5	16.2	14.8	5.5	4.9
Papua New Guinea	8.7	15.7	15.1	28.2	10.3	19.3	6.4	11.7	9.9	14
Paraguay	17	19.3	38	43.4	13.3	15	5	5.6	3.3	3.7
Peru	9.6	9.5	46.7	47.8	13.9	14.2	19	19.3	6.8	6.8
Philippines	22.6	33.1	13.6	22.9	16.4	23.5	3.3	4.8	12.8	17.8
Poland	97.8	52.7	83.7	43.7	76.2	41.1	22.7	12.4	8.4	4.7
Portugal	82.1	38.1	135.7	59.5	125.3	54	35.2	15.5	20.2	9.2
Puerto Rico	26.2	15	159.7	101.7	55.7	34.1	9.6	5.3	14.3	8.9
Qatar	3	10.3	3.6	15.5	5	13.5	1.5	5.5	1.8	5.7
Republic of Moldova	68.3	50.5	43	32.1	64.1	47.3	24.9	18.5	27.8	20.9
Romania	90.4	50.7	63.6	30.5	68.5	36.3	24.2	12.6	23.5	12.7
Russian Federation	72.3	48.2	59.9	39.4	49.5	32.9	30.6	20.4	8.9	6
Rwanda	1.8	4.4	11.5	29.1	5.8	12.6	7.2	11.4	7.9	14.7
Saint Lucia	18.2	12.9	91	71.4	18.2	13.3	15.9	12.3	3.4	2.2
Samoa	33.3	44	38.2	51.5	23.5	30.6	5.9	7.7	13.7	17.3
Sao Tome and Principe	9.6	18.2	12.5	34	2.9	9.5	7.7	11.6	6.7	14.8
Saudi Arabia	3.6	5.8	3.2	6.1	12.5	14.9	1.9	2.6	3.5	6.2
Senegal	1.6	3.7	12	32.2	2.8	6.3	3	6.7	8.4	18
Serbia	125.4	71.6	74.3	35.4	88.2	49	18.6	10.2	10.7	5.9
Sierra Leone	1.5	3.2	10.2	29	2.7	5	3.1	6.9	6.5	12.6
Singapore	75.4	41.5	117.8	64.1	69.7	38.9	19.9	10.8	34.9	19.5
Slovakia	91.4	54.3	89.2	50.5	102.8	60.7	26.1	15.4	12.6	7.7
Slovenia	96.7	46.6	170.1	79.3	125.8	58.9	27.4	12.5	20.9	9.7
Solomon Islands	5.7	11	13.6	24.5	3.8	7.3	1.3	2.3	10.1	15.5
Somalia	1.7	3.7	5.1	13.1	3.9	8.4	2.1	4.8	1.7	3.6
South Africa	19.6	28.2	44.2	68	12.5	18.1	4.1	5.8	5.5	7.6
South Sudan	1.8	3.6	11.1	24.3	4	7.5	2.4	5	3.8	6.5
Spain	89.8	42.1	139.4	73.1	99.9	45.2	20.9	9.2	21.9	10.9

(*Continued*)

Table 1. **Continued**

Site	Lung		Prostate		Colorectum		Stomach		Liver	
	Crud Rate	**ASR**	**Crud Rate**	**ASR**	**Crud Rate**	**ASR**	**Crud Rate**	**ASR**	**Crud Rate**	**ASR**
Sri Lanka	10.6	8.3	5.3	4	7.3	5.8	5.9	4.6	4.7	3.6
Sudan	1.6	2.9	4.5	9.2	3.6	6.2	1.6	3	2.8	4.8
Suriname	25.6	25.7	62.1	69.3	17.9	18.8	7	7	8.8	9
Swaziland	1.6	4.3	12.2	34.2	2.4	4.6	0.3	1.1	3	5
Sweden	39.4	16.9	211.6	103	67.4	29.7	9.7	4.2	12.8	6.5
Switzerland	57.4	26.6	160.1	77.4	61.3	28.4	15	7.2	15.7	7.3
Syrian Arab Republic	16.8	26.6	12.3	20.1	9.4	14.3	4.6	7.1	2.2	3.4
Tajikistan	4.6	7.5	1.2	2.3	3.6	4.9	11.7	20.2	3.6	6
Tanzania, United Republic of	0.38	0.85	14.9	36	3.4	7.4	1.8	3.8	4	8.1
Thailand	45.9	29.4	19.2	12.3	26.7	17.6	6.3	4.1	48.3	32.2
The Netherlands	76.5	34.5	149.4	68.9	100.1	45.3	14.2	6.2	7.3	3.4
The former Yugoslav Republic of Macedonia	87.2	55.7	67.7	39.2	49.6	30.9	24.9	15.4	11.6	7.1
Timor-Leste	7.6	15	3.7	8	4.9	9.7	2.5	5.5	4	7.3
Togo	1.4	3.1	7.8	20.4	3.8	7.2	4.2	8.7	5.2	9.7
Trinidad and Tobago	28.7	21.8	89.6	68.1	28.3	21.5	8.1	6.2	5.3	3.9
Tunisia	30	26.5	14.2	12.3	14.7	13	6.5	5.6	2.8	2.5
Turkey	72.8	70.6	42.9	41.7	28.6	27.4	18.4	17.6	6.9	6.6
Turkmenistan	11.4	15.7	3.3	5.6	4.7	6.7	11.7	17.3	6.1	8.4
Uganda	1.4	4.3	9.5	34.5	3	8.3	1.7	5.5	5.3	10.1
Ukraine	66.7	41.7	54.6	32	55	33.6	28.3	17.5	4.9	3.2
United Arab Emirates	2.1	7	3.7	15.8	6.4	14.8	1.1	4.1	0.9	4.3
United Kingdom	82.2	35.5	171.6	80.7	80.8	37.8	12.5	5.3	14.7	7
United States of America	75	40.1	131.5	75.7	50	28.8	10.2	5.6	16.9	10.4
Uruguay	69.1	46.2	90.1	59.6	68.7	43.8	19.4	12.5	6.8	4.4
Uzbekistan	10.3	14.1	2.8	4.2	5	6.5	9.9	13.8	4.9	6.8
Vanuatu	8.4	14.4	15.4	25	2.8	4.3	1.4	2.2	15.4	20.2
Venezuela, Bolivarian Republic of	18.3	19.7	46.2	51.2	13.8	14.8	8.5	9.2	4	4.3
Viet Nam	35	35.4	8.3	8.4	15.9	16	23.4	23.3	41	39
Yemen	1.8	3.9	0.81	1.8	4.4	9.5	3.7	8.6	2.8	6.3
Zambia	1.3	4	14.1	45.6	1.9	4.9	1.3	3.4	1.2	2.8
Zimbabwe	2.2	5.8	2018	43.5	4.6	11.6	2.6	6.9	3.9	8.7

However, more than 50% of deaths from prostate cancer have occurred in more developed countries.[6–5] Based on cancer record results in 2018, prostate cancer has the highest incidence in men with 1,276,106 cases (29.3% in 100,000) after lung cancer (31.5% in 100,000). With a mortality of 6.7 per 100,000, it is the sixth leading cause of death from cancer in men. Results showed the highest incidence of lung cancer was found in Australia and New Zealand (86.4% in 100,000), Northern Europe (85.7% in 100,000), and Western Europe (75.8% in 100,000). The highest mortality rates related to the highest incidence of prostate cancer in the world was in France, Guadeloupe (189.1 in 100,000), France, Martinique (158.1 in 100,000), and Ireland (13.13 in 100,000) (Table 1, Fig. 9), respectively.

According to the results of 2018, the highest mortality rate for prostate cancer was in Barbados (48 per 100,000), Jamaica (41.7 per 100,000), and Benin (36.3 per 100,000), respectively (Table 2).
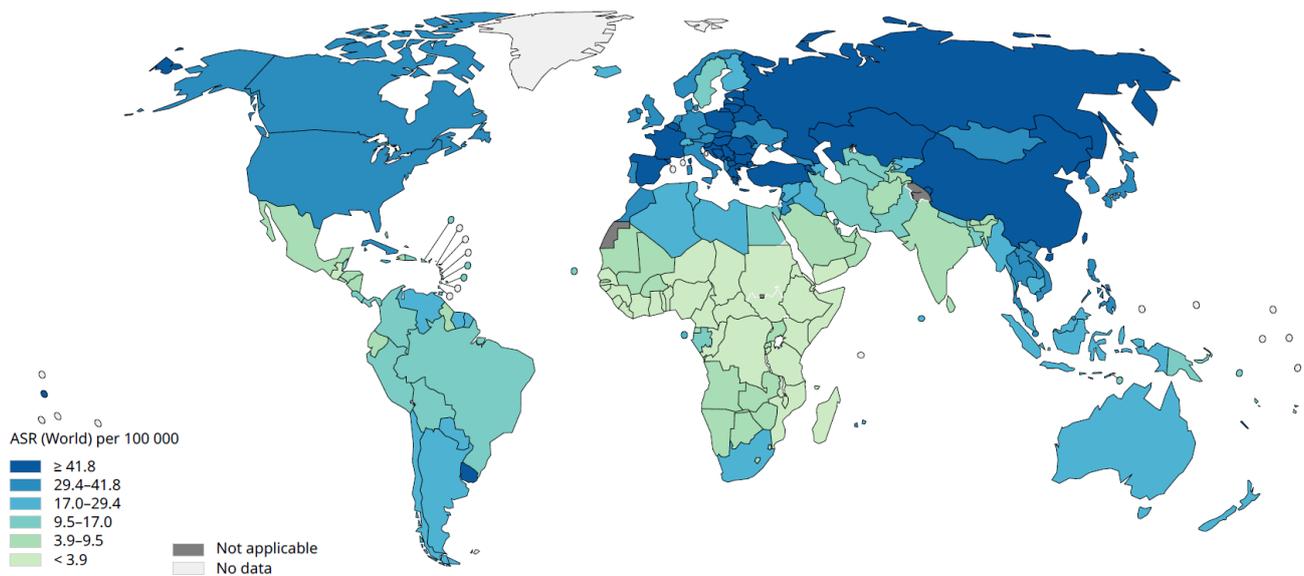
Fig. 7 **Global map presenting age-standardized incidence rates by world countries for lung cancer in males in 2018.**
Source: GLOBOCAN 2018.

Table 2. **Mortality rates (age-standardized rate) for the five most common cancers in males in world (2018)**

Site	Age-standardized mortality rates									
	Lung		Prostate		Colorectum		Stomach		Liver	
	Crud Rate	**ASR**	**Crud Rate**	**ASR**	**Crud Rate**	**ASR**	**Crud Rate**	**ASR**	**Crud Rate**	**ASR**
Afghanistan	4	9.5	1.3	3.8	2.3	4.2	4.5	11.4	2	4.7
Albania	58	33.1	20.3	9.6	7.8	4.5	24.4	14.3	17.5	9.6
Algeria	15.6	17.3	4.9	4.5	7.9	8.5	5.9	6.5	1.4	1.6
Angola	1.6	4.2	7.6	25.2	1.7	4.3	1.3	3.2	2.3	4.8
Argentina	30.8	24.7	18.2	12.3	21.7	16.6	9.4	7.5	5.5	4.4
Armenia	76.1	54.5	26.5	16.8	18.3	12.6	24.1	16.1	19	13.5
Australia	41.7	20.3	26.7	10	26.2	12.8	6.2	3.1	13.1	7.2
Austria	61.7	28.1	29.4	9.5	30.7	12	10.4	4.3	16.2	7.2
Azerbaijan	23.4	24	3.1	3.7	9.7	10.2	17.4	18.3	3.7	3.9
Bahamas	12.3	10.1	40.9	34.1	14.3	12.3	7.2	6	5.1	3.9
Bahrain	5.5	15.2	1.4	4.3	4	8.9	1.5	3.5	1.8	3.7
Bangladesh	10.6	13.5	2	2.4	3.1	3.5	5.4	6.6	2.5	3.1
Barbados	19.7	11.8	101.4	48	38.7	21.4	10.9	5.8	5.1	3
Belarus	58.3	38.3	21.6	13.6	29.9	19.2	23.9	15.6	5.7	3.8
Belgium	82.3	37.6	26.8	8.7	29.4	11.9	8.8	3.8	11.1	5.1
Belize	10	15.7	16.3	27.6	3.7	6.2	5.8	8.1	7.4	12.2
Benin	0.54	0.94	14.5	36.3	3.3	6.8	4.9	10.8	4.1	9.9
Bhutan	5.1	6.6	0.69	1	4.4	5.5	18.2	23.4	6.2	7.6
Bolivia, Plurinational State of	9.7	9.9	8.9	9.1	3.5	4.1	7.3	8	5.3	5.5
Bosnia and Herzegovina	100.6	53.8	27.1	11.5	36.5	18.2	20.7	10.6	16	7.9
Botswana	3.4	6.4	3.9	9.3	1.7	3.2	0.52	0.93	3.4	6.3
Brazil	17.4	15.4	16.1	13.6	11.6	10.1	9.6	8.5	6.7	5.9

(*Continued*)

Table 2. **Continued**

Site	Lung		Prostate		Colorectum		Stomach		Liver	
	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR
Brunei	18.8	26.3	3.1	5.2	14.3	18.5	8.5	12.4	11.6	14
Bulgaria	87.3	44	32.7	12.5	48	21.3	19.7	9.1	11.1	5.4
Burkina Faso	1.7	4.6	5.1	20.6	2	4.8	3.7	9.2	7.8	18.7
Burundi	1	2.5	8.3	23.4	3	7	1.8	4.5	5.2	9.7
Cabo Verde	9.4	16.3	21	30.1	2.2	4.2	16.3	23.4	9.4	11.8
Cambodia	12.4	21.1	1.6	3.3	5.2	8.8	2.6	4.4	21.4	34.7
Cameroon	1.5	3	9.4	22.4	2.6	5.8	1.6	3.3	5.5	9.2
Canada	57.9	25.4	21.7	7.8	27.7	12.2	6.2	2.8	12.6	6
Central African Republic	1.5	3	10	21.3	3.1	6.3	1.6	3.3	3.9	6.9
Chad	0.75	2	4.3	13.5	2.2	5.6	1.4	3.4	3.3	7.5
Chile	22.8	16.1	25.2	15.8	17.3	11.9	26	17.9	8.7	6.1
China	64.4	43.4	7.1	4.7	19.4	13.1	37	25	37.3	25.6
Colombia	12.2	11.5	13	12	9.1	8.4	14.2	13.2	4.8	4.5
Comoros	0.24	0.38	7.6	19.5	1.9	4.1	1.2	2.5	4.3	7.8
Congo, Democratic Republic of	1.4	3.7	9	23.8	3.1	7.5	3.3	6.8	5.9	11.9
Congo, Republic of	1.6	3.4	11.1	23.8	2.1	4.1	1.9	3.6	4.8	8
Costa Rica	10.4	7.7	18.5	12.2	12.8	9.5	18.7	13.9	9.6	7.2
Croatia	104.4	50.1	42.7	15.5	64.1	27.4	22	9.9	18.1	8.4
Cuba	64.4	33.6	54.3	22.3	21.4	10.2	9.8	5	7.8	4.1
Cyprus	69.3	42.2	31.8	15.1	25.9	14.6	10.1	6.1	10.8	6.3
Czech Republic	65.6	30.8	29.2	11.9	37.8	17.4	10.7	5.1	10.8	4.8
Côte d'Ivoire	1.6	3.4	12.2	28.9	2.1	3.9	1.5	2.9	5.6	9.8
Denmark	74	30.3	47.3	15.8	35	13.7	8.8	3.9	12.9	5.9
Djibouti	2.1	3	3.1	5.3	3.7	5.4	1.6	2.5	2.1	2.9
Dominican Republic	13.6	13.7	32.4	28	7.9	7.9	6.1	6.2	6.5	6.7
Ecuador	6.9	6.6	15.9	13.9	6	5.9	13.4	12.8	5.6	5.5
Egypt	8	11.1	2.5	4.3	3	3.8	1.9	2.5	36.2	48.4
El Salvador	6.8	6.1	17.5	12.8	4.8	4.5	11	9.7	6.7	6.2
Equatorial Guinea	2.6	6.3	7	19.4	2.5	5.8	1.2	2.9	4.5	6.5
Eritrea	1.6	3.3	2.5	5.4	3	5.9	1.4	2.9	1.9	3.7
Estonia	86.6	45.1	50.9	21.8	38.2	17.8	24.2	12.7	9.3	4.8
Ethiopia	2	3.8	2.2	4.6	3.2	6.3	1.5	3	1.4	2.7
Fiji	6.9	7.7	10.2	12.8	5.8	7.9	3.7	3.9	11.5	12.2
Finland	51.5	20.8	33.4	10.8	27.6	10.8	9	3.7	13.8	5.5
France	81.5	38.9	28.1	8.1	33.7	13.1	10.9	4.7	23	10.4
France, Guadeloupe	23.6	11.8	63	20	29.3	13.1	23.1	10	9.6	4.2
France, La Réunion	54	35.9	23.9	14	16.8	10.9	15	9.7	14	9.3
France, Martinique	30.3	12.3	65.1	18.7	32	13.3	26.3	10.3	12.6	5.1

| Site | Age-standardized mortality rates | | | | | | | | | |
| | Lung | | Prostate | | Colorectum | | Stomach | | Liver | |
	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR
France, New Caledonia	63.9	47.7	17.7	12.8	16.3	13	12.8	9.8	13.5	10.6
French Guyana	15.2	19.2	11.7	16.1	5.5	7.3	6.9	9	7.6	9.5
French Polynesia	57.7	49.6	24.1	21.4	6.2	5.6	8.2	7.1	15.8	13.4
Gabon	6.8	10.8	9.8	15.5	2.4	3.8	2	3.4	3.1	3.9
The Gambia	2.7	6.3	1.7	4.9	0.65	1.5	0.93	2.3	24.9	41.1
Gaza Strip and West Bank	11.5	25.5	2.4	6.4	6.2	13.3	2.8	5.8	1.2	2.4
Georgia	51.3	33.4	15.1	8.5	12.1	7.5	16.2	10.3	12.2	8
Germany	79.3	31.8	39.1	11.3	36.8	13	14	5.3	14.6	5.7
Ghana	0.88	1.7	7.5	18.1	3.2	7.1	3	5.8	13.6	24.3
Greece	122	54.6	33.8	8.8	36.2	12.7	15.6	6	17.9	6.7
Guam	65.6	51.5	21.5	16.3	14.3	11.6	4.8	3.2	23.8	19.2
Guatemala	2.5	3.8	9.7	13.2	2.4	3.5	8.2	12.3	9.8	15.4
Guinea	1.8	3.2	10.5	28.2	0.99	1.9	2.9	5.8	13.2	25
Guinea-Bissau	1.3	2.6	5.2	15	3	6.9	3.4	7.7	9.1	17.5
Guyana	3.5	5	10.6	15.4	3	3.5	2.8	4	2.5	2.8
Haiti	3.7	5.5	23.6	36.2	4.9	6.7	9.4	13.6	6.3	9.1
Honduras	4.3	6.4	8	11.6	3.7	4.9	6.9	10.4	5.9	8.2
Hungary	116.2	62.9	26.6	11.8	62.2	31.2	19.4	9.9	13.6	7.3
Iceland	40.7	20.2	37.2	14.8	27.1	13.4	5.3	2.6	10	5.1
India	6.5	7.3	2.4	2.9	4.1	4.6	5	5.7	2.5	2.8
Indonesia	14.7	17.4	3.7	5.7	7.7	9.3	1.5	1.9	10.5	12.3
Iran, Islamic Republic of	10.4	11.3	7.4	8.3	5.8	6.3	14.4	15.9	4.8	5.2
Iraq	7.7	17	0.8	2	2.2	4.4	2.2	4.4	1.4	3.1
Ireland	46.2	25.3	24.5	11.4	28.8	15.2	8.2	4.4	10.3	5.7
Israel	36.2	26.7	10.3	5.6	17.1	11	7.4	5.2	5.6	4.1
Italy	83.1	28.7	24.5	6	39.7	12.8	19.5	6.5	24.6	9.2
Jamaica	25.6	19.4	64.4	41.7	12.9	9.8	9.9	7.8	3.7	2.9
Japan	92.3	26.5	20	4.4	48.7	15.2	50.2	14.3	29.9	8.6
Jordan	17	29.3	2.5	4.9	5.1	8.5	4.7	8	1.9	3.3
Kazakhstan	35.5	39.5	5.6	7	11.5	13.3	19.6	22.1	6.8	7.6
Kenya	1.5	3.6	6.6	18.3	2.9	6.8	3.9	9.8	3	6.2
Korea, Democratic Republic of	48.8	44.3	1.7	1.8	11.3	10.4	18	16.3	27.9	23.5
Korea, Republic of	58.1	31.4	8.8	4.7	21.3	11.8	17.9	10	34.5	19.5
Kuwait	4.2	8	2.2	7.5	4	7.4	1.7	2.9	3.4	6
Kyrgyzstan	16.1	24.3	2.7	4.7	4.5	6.4	18	26.6	8.3	12.2
Lao People's Democratic Republic	17.5	28.8	1	2.1	5.7	9.4	9	14.4	20.5	33.4
Latvia	77.3	41.2	48.4	21	36.2	17.3	30.7	16	9.8	5.3
Lebanon	34.4	28.9	16.7	11.9	14.8	11.7	8.8	7.2	4.2	3.5

(Continued)

Table 2. **Continued**

| Site | Age-standardized mortality rates | | | | | | | | | |
| | Lung | | Prostate | | Colorectum | | Stomach | | Liver | |
	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR
Lesotho	3.2	6.4	9.2	17.7	1.9	3.6	0.27	0.7	3.7	6.6
Liberia	1.8	3.7	10.9	29	1.5	3	2.3	4.7	10.4	19.2
Libya	15.4	23	2.9	4.6	5.9	8.5	2.4	3.5	2.2	3.4
Lithuania	82.8	45.1	41.5	18.1	40.4	19.6	33.2	17.4	10.3	5.5
Luxembourg	51.9	28.4	18.9	8.2	24.3	12.3	8.1	4	12.1	6.5
Madagascar	0.65	1.3	7.4	18.6	2	4.2	1.2	2.5	4.5	8.5
Malawi	0.81	2.3	3.7	10.4	1.3	2.9	1.2	3	1.9	2.9
Malaysia	18.1	19.9	4.8	5.6	11.3	12.5	4.3	4.7	8.9	9.6
Maldives	10.7	16.6	4.3	6.6	6.7	10.5	0.4	0.36	8.3	12.1
Mali	1.9	5.5	3.8	12.2	3	7.3	5	12	4.2	9.7
Malta	69.6	29.6	19.8	7.7	32.3	13.2	14.7	6.4	7.4	3.6
Mauritania	1.9	3.9	5.2	13.9	2.1	3.8	3.5	6.8	9.8	16.9
Mauritius	22.5	15.7	13.9	9.8	14.7	10.3	8.6	6	4.3	2.9
Mexico	6.3	6.5	10.6	10	5.7	5.9	4.9	5	5.2	5.3
Mongolia	20.4	32.4	1.1	2.1	2.7	4	25.3	36.7	69.1	98.4
Montenegro	86.3	51.9	25.1	12.2	20	11.2	9.7	5.7	10.6	5.7
Morocco	32.4	32.1	10.4	10.9	7.7	7.7	6.1	6.1	1.3	1.3
Mozambique	0.86	2	6.8	16.9	1.5	3.2	0.76	1.8	4.7	9.4
Myanmar	16.4	19.3	1.4	2	6.1	7.1	12.7	14.8	13.6	14.7
Namibia	2.8	5.5	7.9	19.4	2.3	4.3	1.5	3.1	2.5	4.2
Nepal	11.1	14.1	0.63	0.79	3.1	3.9	5.8	7.3	1.1	1.3
New Zealand	37.4	18.5	28.7	11.6	28.1	13.4	8.3	4.2	11.3	6.4
Nicaragua	5.4	6.9	12.2	14.2	4.7	5.9	8.8	11.3	9.4	12.3
Niger	0.33	0.89	1.1	3.4	2.5	5.3	1.8	4.1	5.3	11.5
Nigeria	0.8	1.6	5.8	16.3	2.2	4.5	1.3	2.8	3.2	6.1
Norway	46.3	22.3	43	16.1	33.8	15.3	7.7	3.6	8.1	4.2
Oman	2.9	6.7	1.1	3.5	4.3	6.8	4.2	9.7	2.7	5.6
Pakistan	7.4	11	3.3	5	2.7	3.7	2.2	3.1	2.5	3.6
Panama	10.6	9.4	20	15.4	9.5	8.4	11.9	10.7	5.4	4.7
Papua New Guinea	8.7	15.7	7.2	15.7	7.2	14	5.9	11.1	8.3	12.5
Paraguay	16.4	18.5	13	13.9	8.1	9	4.4	4.9	3.3	3.7
Peru	8.8	8.7	16.7	15.6	7.5	7.5	14.6	14.5	6.5	6.5
Philippines	20.6	30.7	6.3	12.6	9	13.9	2.7	4.1	12.6	17.7
Poland	93.1	49.5	31.3	14.5	44	22.6	20	10.7	7.1	3.9
Portugal	75	33.5	38.6	10.6	51.3	18.7	28.4	11.4	20.1	8.9
Puerto Rico	21.7	11.8	28.7	12.3	23.5	13.4	7.2	3.8	14.2	8.5
Qatar	2.8	9.9	0.89	4.7	2.7	9	1.5	5.5	1.7	5.6
Republic of Moldova	54.6	40.2	18.4	13.7	36.1	26.9	19.6	14.6	23.1	17.3

Site	Lung		Prostate		Colorectum		Stomach		Liver	
	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR
Romania	82.6	45.7	26.1	10.8	39	19.2	20.9	10.6	21.1	11.3
Russian Federation	66.6	44.3	21.4	13.6	29	18.9	25.6	17	9.6	6.4
Rwanda	1.8	4.4	7.1	19	4.2	9.7	7.1	12.6	7.5	14.9
Saint Lucia	17.1	13.6	55.7	34.5	11.4	8.2	15.9	11.6	3.4	2
Samoa	21.6	28.6	13.7	16.6	7.8	10.9	9.8	13.3	4.9	7.1
Sao Tome and Principe	9.6	18.2	6.7	15	1.9	6.6	7.7	11.7	6.7	14.8
Saudi Arabia	3.1	5.1	0.77	1.7	5.6	7.3	1.5	2.3	3.3	5.8
Senegal	1.5	3.6	7.9	21.6	2.1	4.9	3.1	6.8	8.5	18
Serbia	112.7	61.1	29.6	13.1	45.9	23.3	15.1	7.9	12	6.3
Sierra Leone	1.4	3.1	6.4	20	2.2	4.3	3.1	6.8	5.9	11.9
Singapore	69.7	38.2	15.4	8.1	36.7	20.2	14.3	7.8	32.3	17.7
Slovakia	66.3	38.2	36.6	19.7	51.9	29.5	14.3	8.3	11.4	6.7
Slovenia	81.3	37.7	40.6	14.4	40.9	17.1	18.4	7.8	16.9	7.6
Solomon Islands	7.3	14.1	3.8	6.9	3.5	6.7	1.3	2.3	13.6	20.7
Somalia	1.6	3.6	3.6	9.7	3.6	7.9	2.1	4.8	1.6	3.5
South Africa	18.6	27	15.6	27.9	6.7	10.2	3.3	4.8	5.3	7.2
South Sudan	1.7	3.5	7.4	16.2	3.3	6.6	2.4	5	4	6.8
Spain	77.2	34.4	25.5	7.4	44.1	16.8	15	6.1	17	7.6
Sri Lanka	8.8	6.8	2.9	2.2	5.1	4	4.7	3.6	4	3.1
Sudan	1.5	2.8	2.4	5.3	2.7	4.7	1.5	2.8	2.7	4.7
Suriname	23.1	23.6	26.3	28.3	13.3	14.1	5.6	5.7	9.1	9.7
Swaziland	1.6	4.4	7.9	22.9	1.6	3.5	0.3	1.1	2.8	5
Sweden	36.9	15	50.4	15	32.7	12.4	6.7	2.7	10.4	4.5
Switzerland	49	21.5	34.7	11.1	24.9	10.1	9.6	4.2	13.4	5.8
Syrian Arab Republic	16.5	26.2	4.5	7.3	6.3	9.7	4.5	6.9	2.1	3.4
Tajikistan	4.4	7.1	0.81	1.6	2.9	4	10.9	18.9	3.3	5.5
Tanzania, United Republic of	0.37	0.84	9.3	22	2.4	5.5	1.7	3.8	3.9	8.2
Thailand	41.5	27	8.6	5.3	14.7	9.7	5.2	3.4	48.3	32.3
The Netherlands	71.7	29.7	33.5	11.7	40.5	16.5	9.8	4.1	7.6	3.3
The former Yugoslav Republic of Macedonia	73	45.8	25.9	14.4	23.8	14.2	19.8	11.9	11.7	7.1
Timor-Leste	7.3	14.5	1.5	3.5	3.4	7.1	2.4	5.2	4	7.4
Togo	1.4	3	4.6	13.1	2.8	5.6	4.2	8.6	5.3	9.8
Trinidad and Tobago	23.8	18.2	43.4	34.2	14.2	10.8	6.4	5	5	3.7
Tunisia	28.8	25.5	7.3	5.7	8.6	7.5	6.2	5.4	2.6	2.3
Turkey	70.7	68.6	12.8	11.9	13.8	13.1	15.8	15.1	6.8	6.5
Turkmenistan	10.4	14.4	1.9	3.2	3	4.2	9.8	14.3	5.6	7.6
Uganda	1.3	4.3	5.3	19.7	2.1	6.4	1.6	5.4	4.3	8.8
Ukraine	61.9	38.5	24.4	13.8	34	20.3	24.9	15.3	6.2	3.9

(Continued)

Table 2. **Continued**

Site	Age-standardized mortality rates									
	Lung		Prostate		Colorectum		Stomach		Liver	
	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR	Crud Rate	ASR
United Arab Emirates	2.1	6.3	0.73	4.4	3	7.7	0.97	3.8	0.89	4.2
United Kingdom	60.6	25.2	40	12.7	34	13.3	8.7	3.5	12.3	5.3
United States of America	50.3	25.9	17.7	7.7	17.7	9.6	4.3	2.3	12.7	7.2
Uruguay	63.6	42	34.5	17.1	33.1	19.3	16.9	10.6	4.8	3.1
Uzbekistan	8.7	11.6	2.1	3.1	3.9	5.1	7.9	10.8	4.1	5.5
Vanuatu	9.1	15.6	6.3	10.4	2.8	4.3	1.4	2.2	15.4	20.2
Venezuela, Bolivarian Republic of	16.9	18.2	21.1	23.3	7.5	8.1	7.2	7.7	3.9	4.2
Viet Nam	30.9	31.6	3.9	3.7	8.6	8.7	19.7	19.7	41.3	39.1
Yemen	1.8	3.9	0.27	0.68	3.3	7.5	3.7	8.5	2.7	6.2
Zambia	1.3	4	9.1	28.4	1.2	3.2	1.2	3.4	1.2	2.7
Zimbabwe	2.1	5.8	11.4	29.7	3.3	8.4	2.5	6.8	3.9	6.8
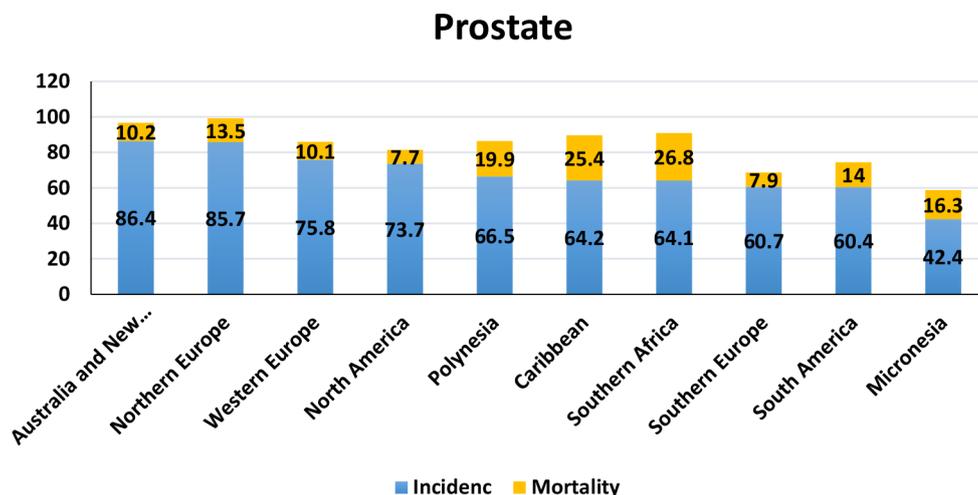
Fig. 8 **Bar chart of region-specific incidence and mortality age-standardized rates for prostate cancer in males 2018. Rates are shown in descending order of the world (W) age-standardized rate.**
Source: GLOBOCAN 2018.

Colorectum Cancer

CRC is the third-most diagnosed cancer and is the fourth leading cause of death worldwide, with around 1.4 million new cases and nearly 700,000 deaths recorded in 2012 due to CRC.[20] In most countries, the incidence of CRC has increased.[21] According to demographic forecasts, the global CRC is expected to increase by 60%, bringing more than 2.2 million new cases and 1.1 million deaths from this cancer by 2030.[22] The disease can be seen as a sign of economic development. In countries undergoing major development shifts, cancer incidences boost with increases in the HDI.[21] An increase in incidence is associated with generations, changes in diet patterns, obesity, and lifestyle factors. Mortality rates is seen more in developed countries, reflecting improvements in survival through the adoption of best practices for treating and managing cancer in the developed countries.

According to the results of the cancer record in 2018, 184,518 cases (about 10.2% of all cancers) were recorded for

CRC in both genders. The highest incidence of CRC based on world areas in men was in Australia and New Zealand (41.7 per 100,000), Southern Europe (40.4 per 100,000), and Central and Eastern Europe (37.5 per 100,000), respectively. The highest incidence is reported from the Central and Eastern Europe (20.5 per 100,000), Southern Europe (15.4 per 100,000), and Northern Europe (13.5 per 100,000) (Fig. 10). According to cancer record results in 2018, Hungary (70.6 per 100,000), Slovakia (60.7 per 100,000), and Republic of Korea, (59.5 per 100,000) have the highest incidence of CRC (Table 1, Fig. 11).

According to the results of 2018, the highest mortality rates for CRC were in males from Hungary (31.2% in 100,000), Slovakia (29.5% in 100,000), and Croatia (27.4% in 100,000) (Table 2).

Stomach Cancer

Gastric cancer is recognized as the fourth most common cancer in the world, and is the second leading cause of cancer
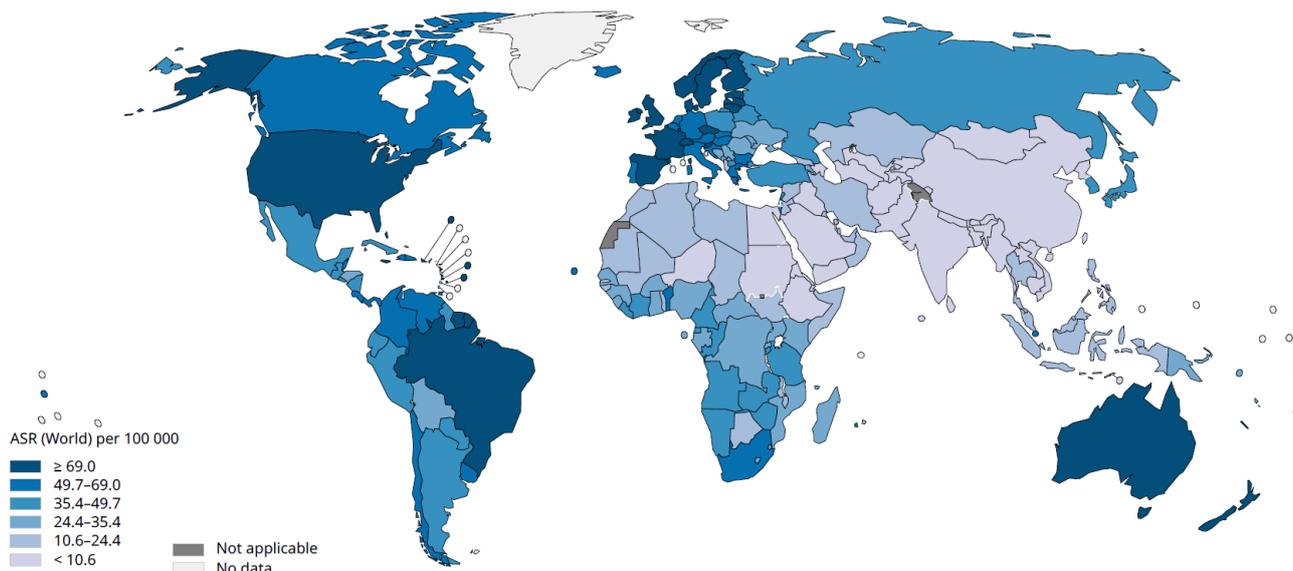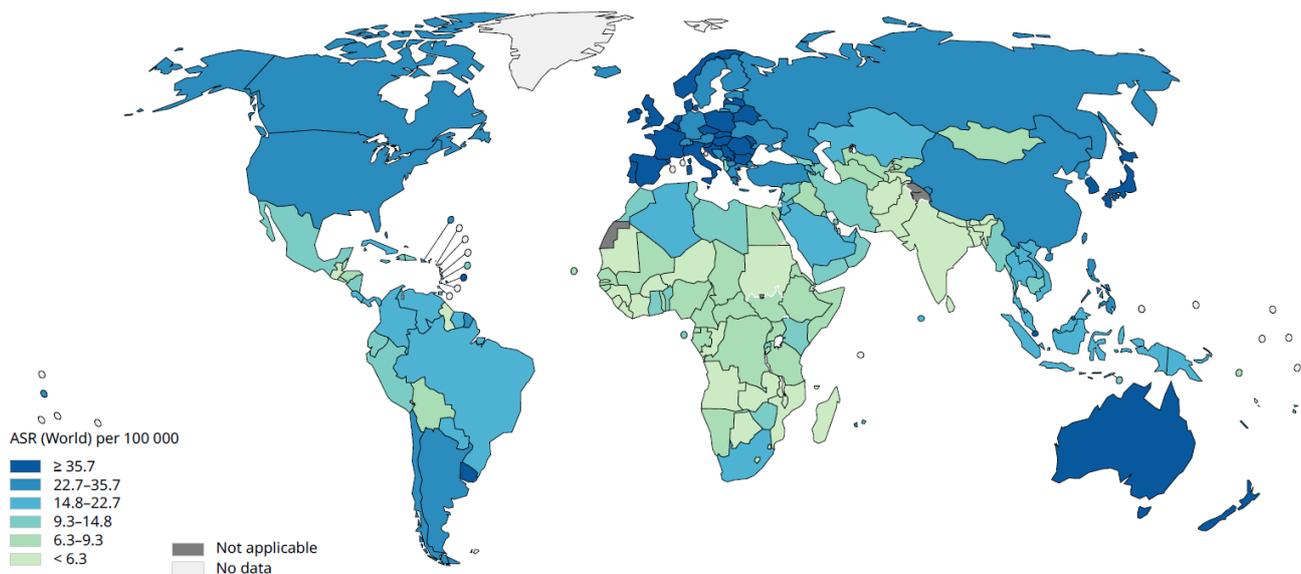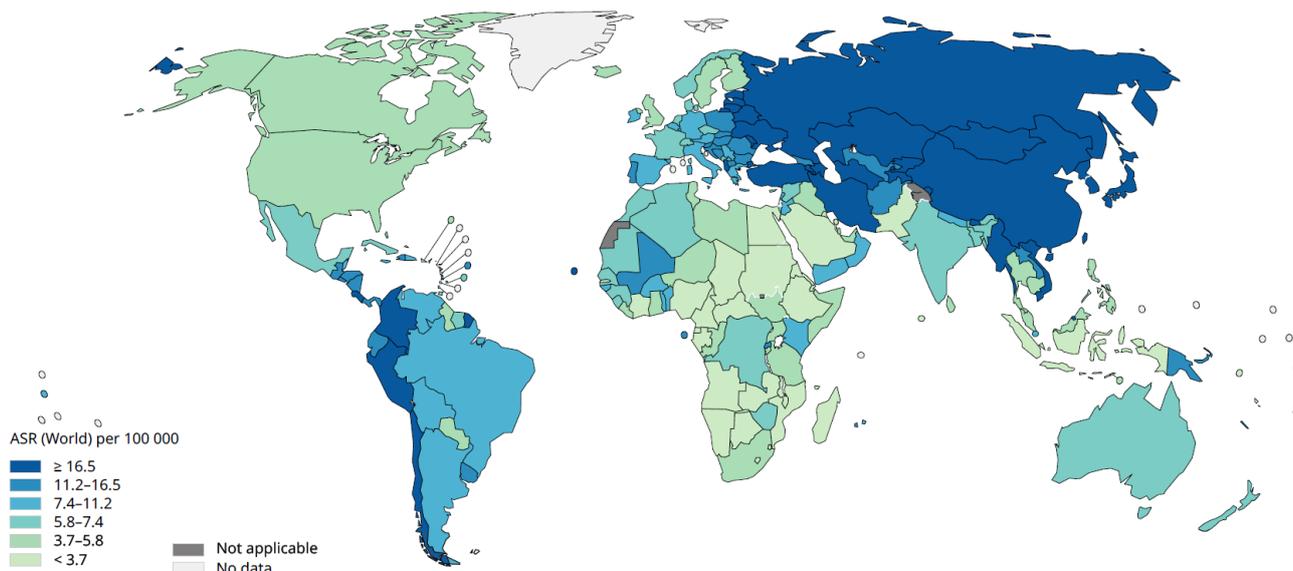
Fig. 9 **Global map presenting age-standardized incidence rates by world countries for prostate cancer in males in 2018.**
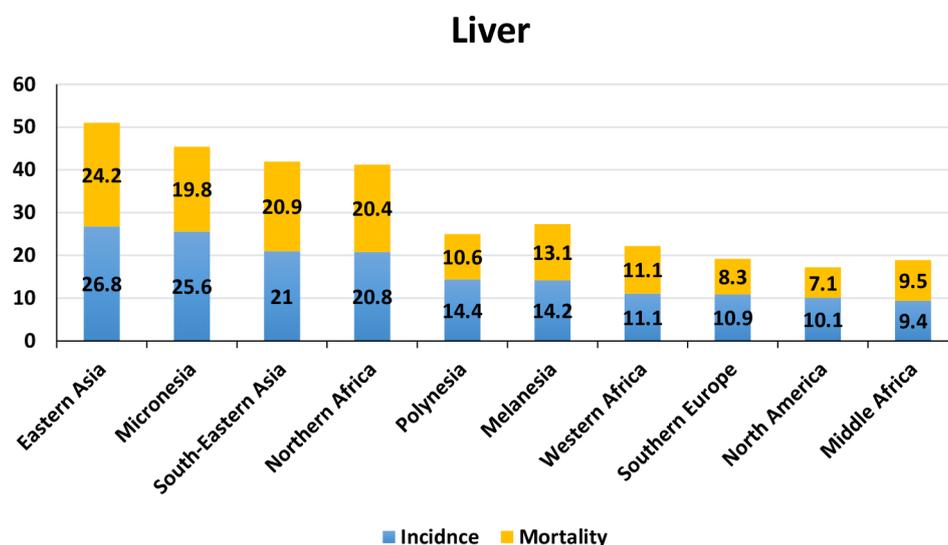**Source: GLOBOCAN 2018.**
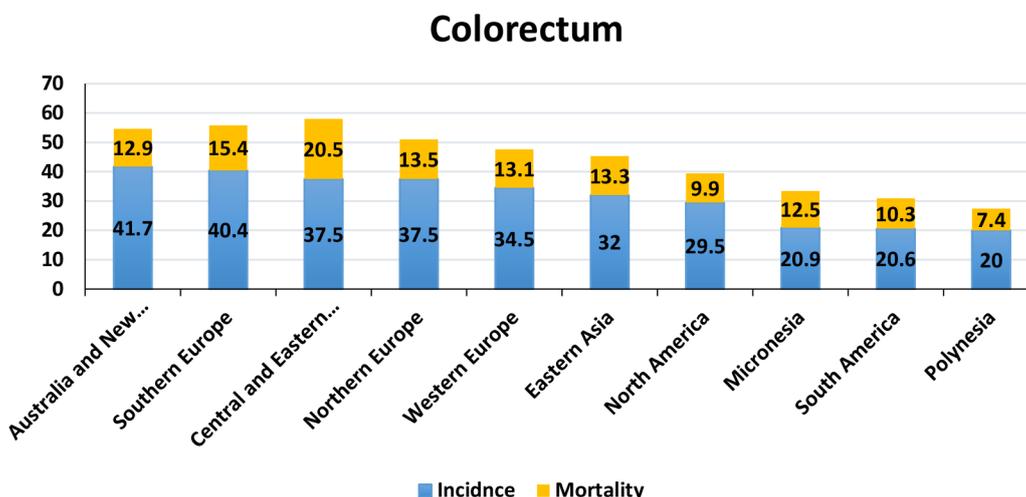
Fig. 10 **Bar chart of region-specific incidence and mortality age-standardized rates for colorectum cancer in males 2018. Rates are shown in descending order of the world (W) age-standardized rate.**
Source: GLOBOCAN 2018.

death. The incidence of this cancer is due to the process of creating a cancerous tumor in stomach in several stages and, therefore, it is classified as a multifactorial disease. The reason for the development of the cancer is the presence of infectious, environmental, and zoonotic agents in humans.[23–25] The prevalence of gastric cancer varies among populations. Genetic and lifestyle variations, especially in dietary habits - such as salt intake - and the difference in detection time, have led to varying cancer incidence in parts of the world which seem to be due to the environmental and racial differences.[26] Gastric cancer is common in countries like China, Chile, Ireland, Costa Rica, northern and southern Korea, Finland, and Iceland.[27]

According to a cancer record in 2018, gastric cancer was identified as the fifth most common cancer in 2018 with 1,033,701 cases (5.7% of total cancers), of which 683,754 cases were in men. Gastric cancer, with 78,285 deaths after lung cancer, was the second cause of death due to cancer in both genders, of which 513,555 cases were in males. According to the world areas, the highest incidence of gastric cancer in men was

Eastern Asia (1.32 per 100,000), Central and Eastern Europe (17.1 per 100,000), and South America (12.7 per 100,000), and the highest mortality rate was reported for Eastern Asia (23 per 100,000), Central and Eastern Europe (14 per 100,000), and Western Asia (10 per 100,000) (Fig. 12). The results showed that the highest incidence was related to the countries of the Republic of Korea (57.8 per 100,000), Mongolia (47.2 per 100,000), and Japan (40.7 per 100,000) (Table 1, Fig. 13). According to the results of 2018, the highest mortality rates for gastric cancer were in males from Mongolia (36.7 per 100,000), Kyrgyzstan (6.26 per 100,000), and China (25 per 100,000) (Table 2).

Cancer Liver

Primary liver cancer is the fifth most common cancer and the third cause of death from cancer in the world. In most countries, primary carcinoma of the liver cells accounts for about 90–75% of liver cancers. It affects both sexes, but it is more prevalent in men (16 per 100,000) than in women (6 per 100,000). The incidence of liver cancer is elevated with age,
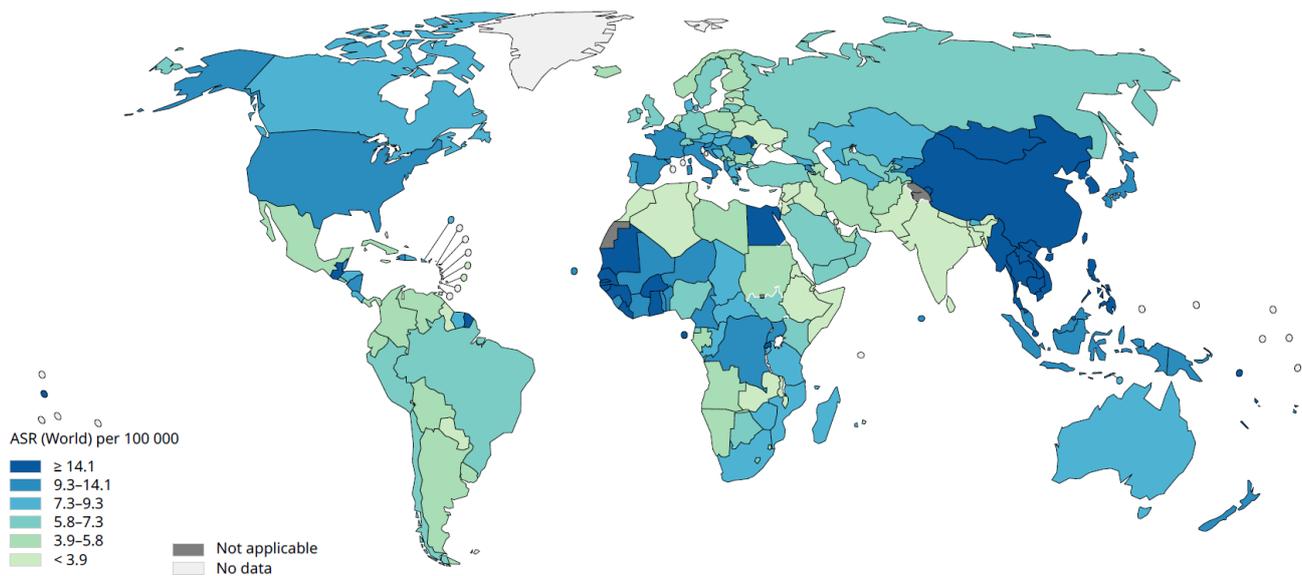
Fig. 11 **Global map presenting age-standardized incidence rates by world countries for colorectum cancer in males in 2018.**
Source: GLOBOCAN 2018.
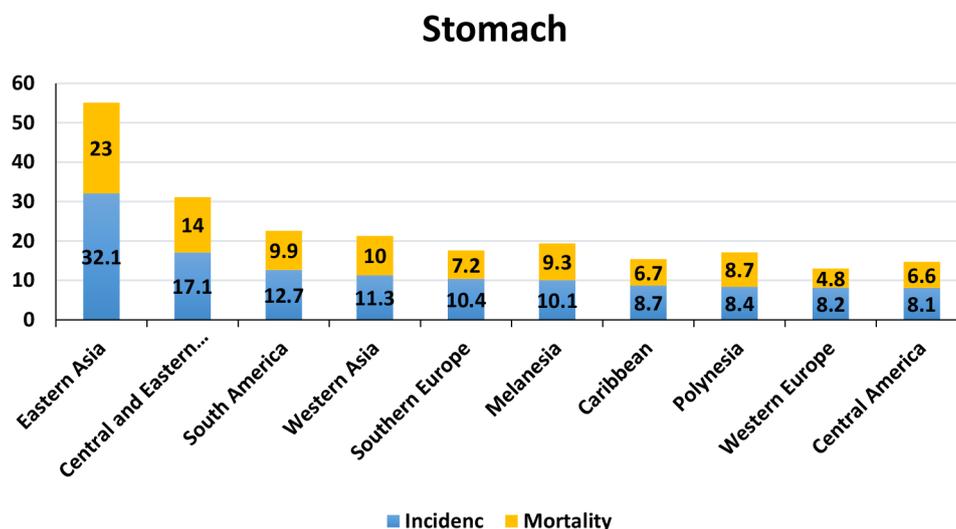
Stomach

Fig. 12 **Bar chart of region-specific incidence and mortality age-standardized rates for stomach cancer in males 2018. Rates are shown in descending order of the world (W) age-standardized rate.**
Source: GLOBOCAN 2018.

the highest incidence prevails among the age group of 70–60 years. The rate of liver cancer has been reported from 10 cases per 100,000 people in North America and Western Europe to 150 cases per 100,000 people in Africa and 50–70 cases in Asia. Therefore, the highest incidence of liver cancer are reported from the regions of East Asia, Southeast, and Central and Eastern Africa and the lowest incidence is in advanced countries (except South America).[28–30] The most important causes of liver cancer, in more than 75% of cases, are chronic hepatitis C and B infections, which can be prevented.[31]

Based on cancer record results in 2018, a total of 841,080 cases (7.4% of all cancers) were related to liver cancer, of which 596,574 cases were in men. According to the same results, 781,631 of deaths are due to liver cancer of which 548,375 were reported for men. According to world areas, the highest incidence of liver cancer in men was related to Easter Asia (26.8 per 100,000), Micronesia (25.6 per 100,000), and South-Eastern Asia (21 per 100,000), and the highest rates

of mortality associated with Easter Asia (2.24 in 100,000), South-Eastern Asia (20.20 in 100,000) and North Africa (4.20 in 100,000) (Fig. 14). The results also showed that the highest incidence of liver cancer is in males from Mongolia (98.4% in 100,000), Egypt (48.4% in 100,000), and Vietnam (39.1 in 100,000) (Table 1, Fig. 15).

According to the results of 2018, the highest mortality rate of liver cancer in men was in Mongolia (98.4% in 100,000), Egypt (48.4% in 100,000), and The Gambia (41.1 in 100,000) (Table 2).

The results of our study revealed that there was a positive and significant correlation between the incidence of lung cancer (R = 0.629, P < 0.0001), prostate (R = 0.534, P < 0.0001), colorectal (R = 0.745, P < 0.0001), and stomach (R = 0.268, P < 0.001) with HDI index, while there was no significant relationship between liver cancer and HDI index (R = 0.079, P > 0.05).

The results also showed that there was a positive and significant correlation between the mortality from lung cancer

Fig. 13 **Global map presenting age-standardized incidence rates by world countries for stomach cancer in males in 2018.**
Source: GLOBOCAN 2018.

Fig. 14 **Bar chart of region-specific incidence and mortality age-standardized rates for liver cancer in males 2018. Rates are shown in descending order of the world (W) age-standardized rate.**
Source: GLOBOCAN 2018.

(R = 0.632, *P* < 0.0001) and colorectal (R = 0.627, *P* < 0.0001) with HDI, whereas this correlation in prostate cancer was negative (R = −0.187, *P* < 0.01) and there was no significant correlation between mortality and the HDI in liver and stomach cancers (*P* > 0.05).

Summary and Conclusions

The main reasons for increasing cancer cases in developing countries include population growth, an increase in the percentage of elderly people that is associated with an increase in annual cancer incidence and an increase in the incidence and cancer burden in the future.[32]

It is estimated that the number of new cases of cancer will be approximately 26.4 million and the number of deaths from cancer will reach about 17 million by 2030. Population aging, improving quality of life, technological advancements, lifestyle

changes, and cancer risk factors are among the factors that cause cancer deaths to reach 62,000 by 2020.[32,33]

Studies have shown that HDI can be used as a predictor of lung cancer. High life expectancy and higher mean longevity are the main reasons for increased LC in regions with very high HDI. Since aging cannot be controlled, the risk of developing lung cancer cannot be prevented as well. Other notable points in areas with high HDI are the increased prevalence of smoking in both genders, especially in young people. In high-HDI societies, the problem of air pollution and exposure to pollutants such as aromatic cyclic hydrocarbons, which are an environment friendly carcinogen, is associated with increased lung cancer, especially in the elderly. In previous studies, a positive and direct correlation between lung cancer and the annual average of dust has been confirmed. Therefore, lung cancer with the highest global incidence and mortality and its upward trend by 2040 worldwide is significant. The human

Fig. 15 **Global map presenting age-standardized incidence rates by world countries for liver cancer in males in 2018.**
Source: GLOBOCAN 2018.

A) Lung cancer
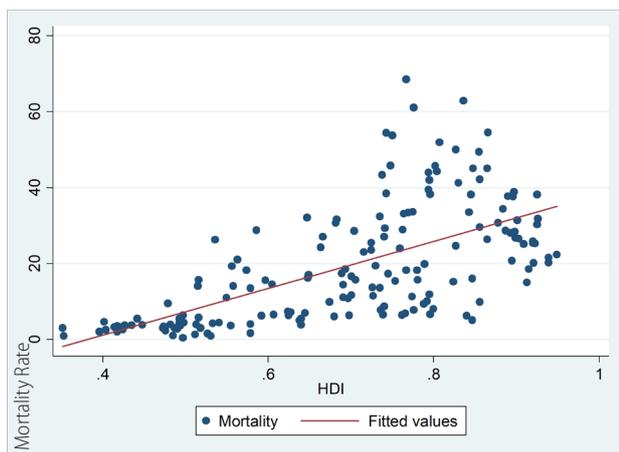
R Sq. linear = 0.629, $P < 0.0001$
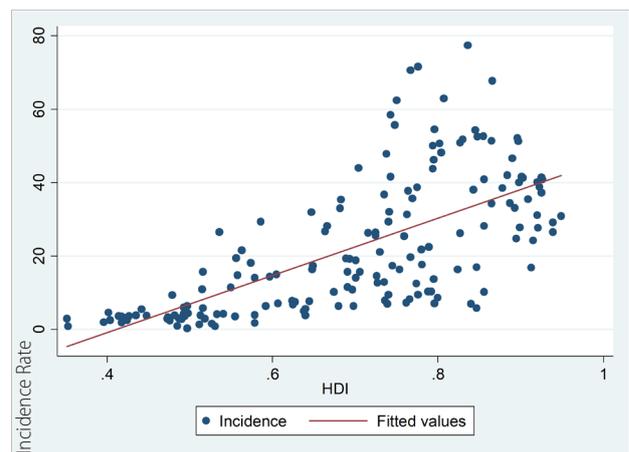
R Sq. linear = 0.632, $P < 0.0001$

B) Prostate cancer
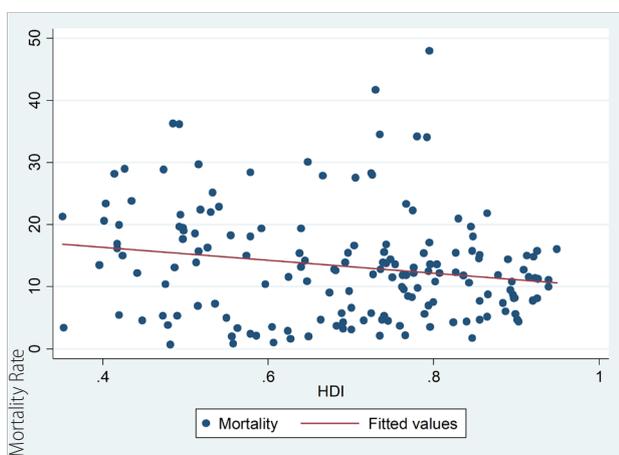
R Sq. linear = 0.534, $P < 0.0001$
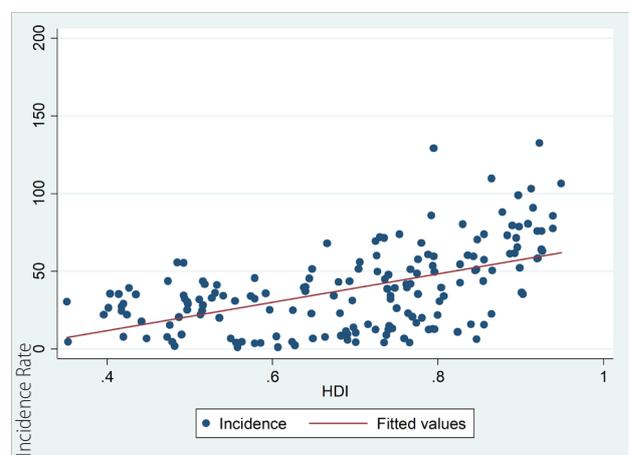
R Sq. linear = -0.187, $P < 0.01$

Fig. 16 **Correlation between incidence and mortality rates with human development index for the five most common cancers in males in the world in 2018.**

C) Colorectum cancer
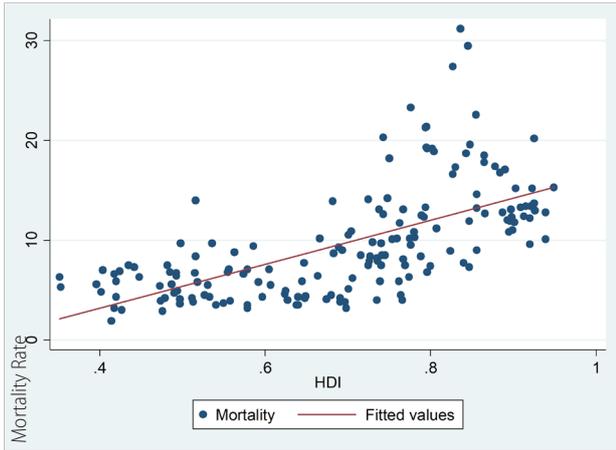
R Sq. linear=0.745, *P* < 0.0001
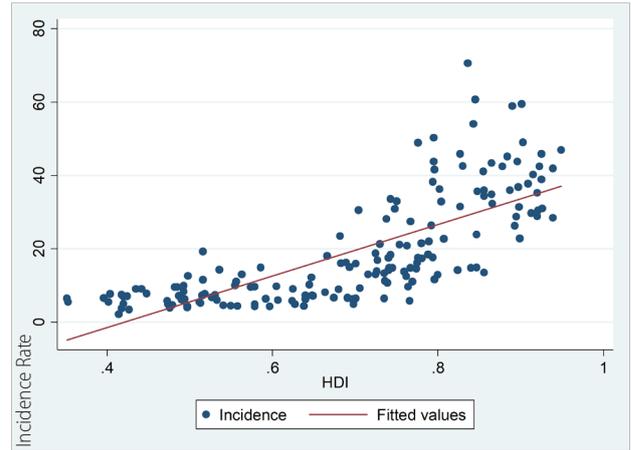
R Sq. linear=0.627, *P* < 0.0001

D) Stomach cancer
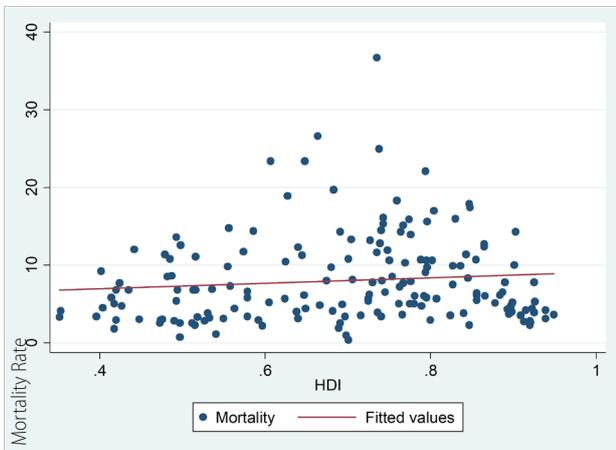
R Sq. linear = 0.268, *P* < 0.0001
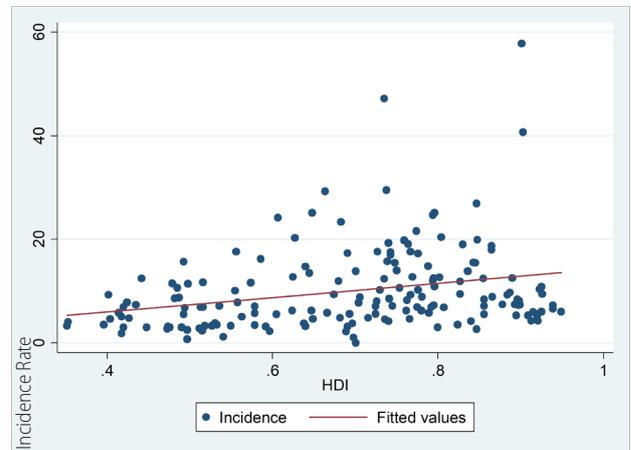
R Sq. linear = 0.098, *P* > 0.05

E) Liver cancer
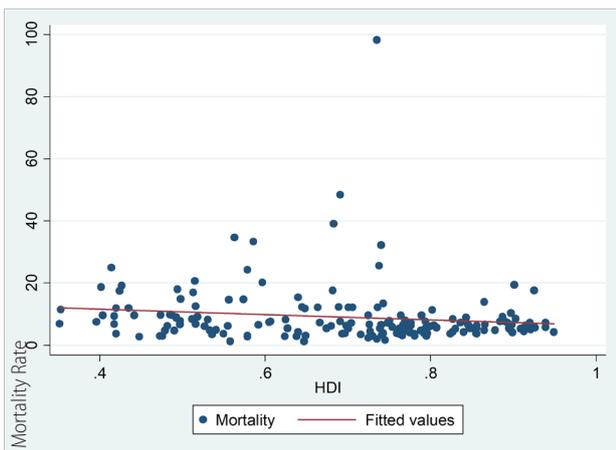
R Sq. linear = −0.079, *P* > 0.05
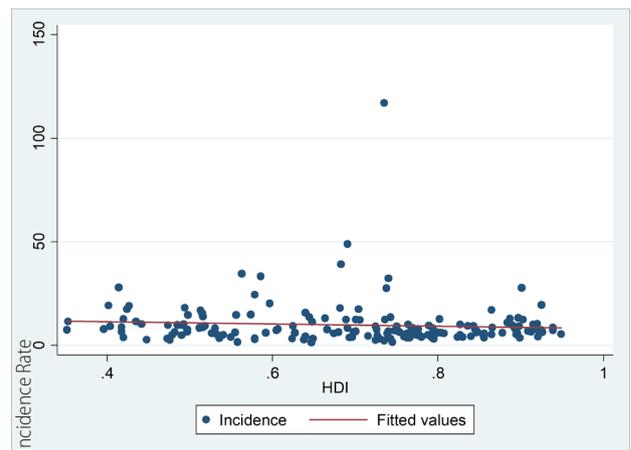
R Sq. linear = −0.138, *P* > 0.05

Fig. 16 **Continued.**

development index, as an important factor, can be effective in reducing the incidence and mortality of the patient. Reducing smoking and tobacco and not being exposed to other risk factors such as asbestos, radon, and air pollution are reasonable decisions in this respect.[6,34,35]

Prostate cancer often affects the elderly and continues to be highly fatal. In most cases, prostate cancer is formed not only because of biological and inherent characteristics of an individual, but also because of environment where they live in. Significant and rapid changes in the incidence of prostate

cancer, long duration, and its potential require a more serious attention to the environmental and lifestyle factors affecting individuals. The difference in the rate of prostate cancer among men in developed countries and in Asian countries is a feedback on their different lifestyles. Other causes of difference in these two categories of people are dietary, sexual, and behavior patterns, alcohol consumption and exposure to ultraviolet[36] radiation. Recent studies have shown that in countries with high and very high HDI, new prostate cancer cases are on the rise, while mortality rates in these countries are lower than in poor countries or those with lower HDIs (such as African and Caribbean countries). One of the main reasons for this difference is the easier access to screening and modern treatments in countries with high and very high HDI.[37,38]

One of the reasons for the high incidence of CRC in countries with a high HDI can be the presence of risk factors for CRC in these countries.[16,39,40] The low mortality rate of CRC in countries with a low HDI can be due to low levels of CRC as the result of lack of proper diagnosis and failure to record and report this cancer.[41–43] Another reason for the difference in the incidence and mortality of CRC with the country's HDI is the existence and use of screening and diagnostic tests, such as sigmoidoscopy and colonoscopy.[44,45] Certainly, changes in lifestyle and westernization factors are likely to be partly responsible for global changes in the incidence of CRC, as well as the increasing trend of incidence in developing countries. These significant risk factors include alcohol intake,[46,47] inappropriate diet (low intake of fruits and vegetables and high consumption of red meat/processed meat),[48,49] obesity,[50,51] physical inactivity,[52] and cigarettes,[53–55] with which they can control the incidence and mortality of cancers, including CRC.

Prevention and treatment of gastric cancer, which is currently one of the most common malignancies worldwide, continues to be a problem.[38] The rate of gastric cancer in men is twice as high as women and varies from country to country.[56] Regional variations in the incidence of this cancer indicate differences in food patterns, consumed food and availability of fresh produce, and the prevalence of *Helicobacter pylori* infection. Repeated infections with *H. pylori* are one of the most important risk factors for detecting gastric cancer, and 90% of new cases of gastric cancer worldwide are associated with this bacterium.[57] Proximal tumors are more common in developed countries and higher social classes. Therefore, the incidence is higher. One of the reasons for a higher incidence in higher HDI countries may be the difference in diagnostic programs in high-HDI countries compared to low-HDI[58] countries. Some foods also have a natural nitrate concentration (cabbage, cauliflower, carrots, celery, radishes, beets, and spinach). Nitrate content in fertilizer, water, and soil also increases nitrate in the diet that can be effective in gastric cancer.[59] Therefore, lifestyle modification is a practical strategy for preventing gastric cancer, especially among the elderly.[59,60]

Hepatocyte carcinoma (HCC) is of global importance due to its high rate of progression and high mortality rates. Almost 85% of LC cases and deaths occur in developing countries and significantly in countries with low and moderate HDIs. It can be said that these countries are often in the process of industrialization, and this affects all aspects of their lives, including those related to health. In countries with low and intermediate HDI, HCC risk factors, including diabetes mellitus,[36] metabolic syndrome, obesity,[38] alcoholic beverages,[39] and HBV and HCV infection are more prevalent, leading to an increased incidence of hepatocellular carcinoma. The incidence and mortality rate of liver cancer in countries with high prevalence, like Japan and China, is declining, which can be attributed to lower levels of aflatoxin contamination, immunization against HBV, and other cancer prevention programs. Reducing chronic schistosomiasis, more health measures in the transmission and donation of blood to prevent HCV infection, and the implementation of policies to prevent unwanted intravenous infusion has also been effective.

Conflict of Interest

None. ◼

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