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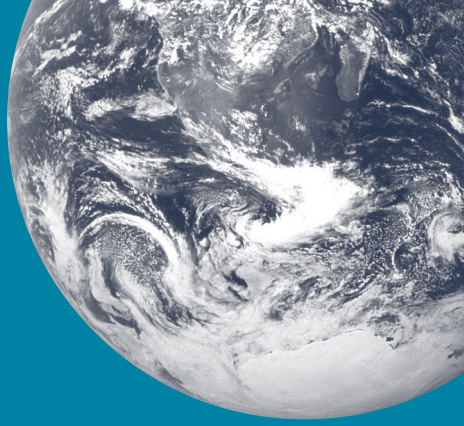

INTERNATIONAL EPIDEMIOLOGY OF GASTRIC CANCER: GEOGRAPHICAL DISTRIBUTION AND SECULAR TRENDS

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Abstract – *Objective:* *The aim of this study was to investigate the geographical distribution of Gastric Cancer (GC) incidence and mortality in the world in 2012, as well as the trend of incidence and mortality of GC during 1975 to 2010 based on the gender.*

Materials and Methods: *In the present study, we extracted the information on the incidence and mortality of GC in 184 countries from the International Agency for Research on Cancer (IARC) (Project GLOBOCAN, 2012). The present study categorized and presented the information on the Age-Standardized Incidence Rate (ASIR) and Age Standardized Mortality Rate (ASMR) of GC based on the continents, world regions based on the development level, WHO regions classification and Human Development Index (HDI). ASIR and ASMR of GC expressed per 100,000 people.*

Results: *The highest ASIR and ASMR of GC occurred in Asia (ASIR=15.8 and ASMR=11.7), less developed regions (ASIR=12.7 and ASMR=10.2), and the WPRO (ASIR=22.8 and ASMR=15.7), and those regions with medium level of HDI (ASIR=14.4 and ASMR=11.8). The incidence and mortality rates of this disease are decreasing in most countries from 1975 to 2010 in the world.*

Conclusions: *The highest incidence and mortality of GC were observed in Asia, less developed regions, and the WPRO and those areas with medium levels of human development index. The incidence and mortality rates of GC were decreasing in both genders and most regions of the world.*

KEYWORDS: *Incidence, Mortality, Trend, Gastric Cancer, World.*

LIST OF ABBREVIATIONS: *GC: Gastric Cancer, WHO: World Health Organization, IARC: International Agency for Research on Cancer, HDI: Human Development Index, ASIR: Age- Standardized Incidence Rate, ASMR: Age- Standardized Mortality Rate, AFRO: WHO Africa region, PAHO: WHO Americas region, EMRO: WHO East Mediterranean region, EURO: WHO Europe region, SEARO: WHO South-East Asia region, WPRO: WHO Western Pacific region.*

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INTRODUCTION

In the past century, Gastric Cancer (GC) has been the most common cancer worldwide. Currently this cancer is not considered as the most common cancer; however, the world's largest number of mortality from cancer is due to the GC[1]. Gastric adenocarcinoma is the most common type of GC and it accounts for almost 90% of new cases of disease[2]. More than 990,000 new cases of GC are annually diagnosed worldwide, and approximately 738,000 cases die from this disease[3]. GC is currently ranked fourth in terms of incidence and second in terms of mortality among all types of cancer[4]. The incidence of GC considerably varies among countries and also among men and women, as it affects men 2 to 3 times more than women[3]. The lowest incidence of disease worldwide is observed in North America and Africa, while the highest incidence of this cancer can be seen in East Asia, Eastern Europe and South America[5]. Environmental and genetic factors contribute to the incidence of GC. Some of the underlying causes of this disease such as *Helicobacter pylori (H. pylori*) infection and smoking are considered as changeable risk factors, but others like gender and age cannot be changed[6]. Risk factors for GC are different based on the type of cancer; however, some risk factors that are common in both types (cardia and noncardia GC) include the family history of illness, smoking, male gender, old age, and radiation. Drugs such as Statins and Aspirin can have protective effects on the GC[2]. Gastric Cancer is more common in the elderly, so that the individuals' average age was 70 years in the United States from 2005 to 2009, and only 10% of patients were in the age group of 20 to 34 years, while the age group of 75 to 84 years included 29% of patients[2, 7]. The incidence of this disease is higher in males than females, so that cardia type of this disease is 5 times and the non-cardia type is 2 times higher in males than females[2,6,8]. This difference in the incidence of disease between males and females is not completely clear, but occupational and environmental factors such as differences in the rate of smoking and gender-based biological and hormone differences may be effective in creation of this difference[9,10]. The epidemiological study of this disease should be continuous and accurate since the burden of this disease is very high on the social health. Moreover, the trend of changes in risk factors of this disease is very different worldwide, due to the population growth and an increase in the proportion of elderly people in human societies. The incidence and mortality of GC are regularly and accurately evaluated and reported in developed countries[7, 11]; however, there are a few comprehensive and international studies on differences in the incidence and mortality of GC based on different geographical areas or socio-economic status[12,13]. There are complete and clear geographical differences in the incidence and mortality of GC in worldwide. In the present study, we aimed to investigate the geographical distribution of GC incidence and mortality based on the development level, WHO classification, human development index (HDI) levels and continents in 2012 as well as the trend of incidence and mortality of GC based on gender from 1975 to 2010.

MATERIALS AND METHODS

In the present study, we extracted the information on the incidence and mortality of GC in 184 countries from the International Agency for Research on Cancer (IARC) (Project GLOBOCAN, 2012). GLOBOCAN is a database on various types of cancers and it is created by the World Health Organization. It covers information on the number, raw rates, and age standardization of cancer incidence, prevalence and mortality for different regions and countries. Currently, the available data in GLOBOCAN is known as one of the newest international database on the cancer. Based on the data of GLOBOCAN project, it is possible to investigate and compare the incidence and mortality of cancer based on the type of cancer, age and gender groups for different regions of the world[14, 15]. The present study categorized and presented the information on the Age-Standardized Incidence Rate (ASIR) and Age Standardized Mortality Rate (ASMR) of GC based on the continents (Africa, Latin America and Caribbean, Northern America, Europe, Oceania, Asia), world regions based on the development level (more developed regions and less developed regions), WHO Region classification (WHO Africa region (AFRO), WHO Americas region (PAHO), WHO East Mediterranean region (EMRO), WHO Europe region (EURO), WHO South-East Asia region (SEARO) and WHO Western Pacific region (WPRO)) and human development index level (very high, high, medium, or low). We provided information about the incidence and mortality of GC based on the number, raw rates and the Age-Standardized incidence and mortality rates in 2012. We also expressed raw and standardized rates of incidence and mortality per 100,000 people. Geographical distribution map was prepared for the ASIR and ASMR of this disease based on the age-specific rates. Detailed descriptions of applied methods are presented in previous reports[13, 16-25].

RESULTS

The ASIR and ASMR of GC in the world

In 2012, 951,594 new cases of GC were diagnosed worldwide. From this number, 631,293 (66.34%) cases occurred in men and 320,301 (33.66%) in women. In general, the worldwide ASIR of GC was equal to 12.1(17.4 in men and 7.5 in women). The sex ratio (male to female) of the newly diagnosed GC was equal to 1.97 (Table 1). There were also 723,073 deaths from GC during 2012. From this number, 468,970 (64.85%) cases occurred in men and 254,103 (34.15%) in women. In general, the ASMR of GC was equal to 8.9 (12.7 were in men and 5.7 in women). The sex ratio of the mortality of GC was equal to 1.84 (Table 2).

The ASIR and ASMR of GC based on the continents

The ASIR of GC was equal to 15.8 (22.8 in men and 9.3 in women) in Asia, 9.7 (12.8 in men and 7.1 in women) in Latin America, 9.4 (13.2 in men, and 6.4 in women) in Europe, 5.1 (6.8 in men, and 3.5 in women) in Oceania, 4 (5.5 in men, and 2.7 in women) in North America, and 3.8 (4.5 in men and 3.2 in women) in Africa. From the total number of this disease in the world, the highest proportion occurred in Asia and the lowest proportion in Oceania, so that 73.5% of cases occurred in Asia, 14.7% in Europe, 6.4% in Latin America, 2.6% in North America, 2.5% in Africa and 0.3% in Oceania (Table 1 and Figures 1-10). The ASMR of GC was equal to 11.7 (16.7 in men and 7.1 in women) in Asia, 8.1(10.8 in men and 5.8 in women) in Latin America, 6.9(9.7 in men, and 4.6 in women) in Europe, 3.5(4.1 in men and 3 in women) in Africa, 3(3.9 in men and 2.1 in women) in Oceania and 2.1 (2.8 in men, and 1.5 in women) in North America. From the total number of deaths of GC in the world, the highest proportion occurred in Asia and the lowest proportion in Oceania, so that 72.9% of cases occurred in Asia, 14.8% in Europe, 7.1% in Latin America, 3% in Africa, 1.9% in North America and 0.3% in Oceania (Table 2 and Figure 1-10).

The ASIR and ASMR of GC based on the development level

The ASIR of GC was equal to 12.7 (18.1 in men, and 7.8 in women) in less developed regions and 10.6 (15.6 in men, and 6.7 in women) in more developed countries, 71.1% of cases occurred in less developed regions and 28.9% in in more developed regions. The mortality of GC was equal to 10.2 (14.4 in men, and 6.5 in women) in less developed regions, and 6.4 (9.2 in men, and 4.2 in women) in more developed regions. 75.8% of cases occurred in less developed regions and 24.2% in more developed regions.

The ASIR and ASMR of GC according to the WHO regions classification

The ASIR of GC was equal to 22.8 (33.4 in men, and 13.1 in women) in WPRO, 10 (14 in men, and 6.8 in women) in EURO, 6.9 (9.2 in men and 5 in women) in PAHO, 5.7 (8 in men and 3.7 in women) in SEARO, 5.5 (7.2 in men and 3.9 in women) in EMRO, and 4(4.7 in men and 3.4 in women) in AFRO. From the total incidence of this disease, 60% of cases occurred in WPRO, 17% in EURO, 9.6% in SEARO, 8.9% in PAHO, 2.4% in EMRO, and 2% in AFRO (Table 1). The ASMR of GC was equal to 15.7 (22.8 in men, and 9.4 in women) in WPRO, 7.4(10.5 in men, and 5.1 in women) in EURO, 5.3(7.3 in men and 3.3 in women) in SEARO, 5.1(6.8 in men and 3.7 in women) in PAHO, 4.9(6.4 in men and 3.5 in women) in EMRO, and 3.7(4.3 in men and 3.2 in women) in AFRO. From the total mortality of this disease, 56.7% of cases occurred in WPRO, 17.4% in EURO, 9% in PAHO, 11.5% in SEARO, 2.9% in EMRO, and 2.5% in AFRO (Table 2).

The ASIR and ASMR of GC according to the levels of HDI

The ASIR of GC was equal to 14.4 (20.9 in men and 8.5 in women) in regions with medium HDI, 11.7 (16.1 in men, and 8.2 in women) in regions with high HDI, 10.9 (16 in men, and 6.7 in women) in regions with very high HDI, and 4.6 (5.6 in men and 3.7 in women) in regions with low HDI. From the total incidence of this disease, 54.6% of cases occurred in regions with medium HDI, 26.9% in regions with very high HDI, 14.8% in regions with high HDI, and 3.7% in regions with low HDI (Table 1). The ASMR of GC was equal to 11.8 (17 in men and 7.2 in women) in regions with medium HDI, 9.5 (13.4 in men, and 6.6 in women) in regions with high HDI, 5.5 (7.9 in men, and 3.5 in women) in regions with very high HDI, and 4.4 (5.4 in men and 3.5 in women) in regions with low HDI. From the total mortality of this disease, 59.3% of cases occurred in regions with medium HDI, 19.8% in regions with very high HDI, 16.3% in regions with high HDI, and 4.6% in regions with low HDI (Table 2).

The trend of GC ASIR and ASMR during 1950 to 2010

The general trend of the incidence of GC was decreasing in males and females from 1975 to 2010; for instance, the incidence rate of this disease in Japanese men reached from 80 to 50 per 100,000 people and from 39% to 19.5 per 100,000 people in Japanese women. Figures 11-14 show the incidence rate for a number of countries based on the gender. There is also a downward trend in the mortality rate of GC from 1975 to 2010; for example, the mortality rate in Japanese men reached from 56.3 to 20 per 100,000, and from 37 to 5 per 100,000 people in Japanese women. Figures 11-14 show the mortality rates in some countries.

TABLE 1. The number, crude and ASIR of GC in different regions of the world in 2012.

Population	Male			Female			All		
	Numbers	Crude Rate	ASR (W)	Numbers	Crude Rate	ASR (W)	Numbers	Crude Rate	ASR (W)
World	631293	17.7	17.4	320301	9.2	7.5	951594	13.5	12.1
More developed regions	175117	28.9	15.6	99392	15.5	6.7	274509	22.0	10.6
Less developed regions	456176	15.5	18.1	220909	7.7	7.8	677085	11.7	12.7
Very High Human Development	168036	29.5	16.0	88224	15.1	6.7	256260	22.2	10.9
High Human Development	84594	16.5	16.1	56419	10.6	8.2	141013	13.5	11.7
Medium Human Development	358122	19.7	20.9	160877	9.3	8.5	518999	14.6	14.4
Low Human Development	20414	3.1	5.6	14703	2.3	3.7	35117	2.7	4.6
WHO Africa region (AFRO)	10496	2.4	4.7	8614	2.0	3.4	19110	2.2	4.0
WHO Americas region (PAHO)	51704	11.0	9.2	33650	7.0	5.0	85354	8.9	6.9
WHO East Mediterranean region (EMRO)	14951	4.7	7.2	8503	2.8	3.9	23454	3.8	5.5
WHO Europe region (EURO)	97679	22.3	14.0	64167	13.8	6.8	161846	17.9	10.0
WHO South-East Asia region (SEARO)	60299	6.4	8.0	30259	3.3	3.7	90558	4.9	5.7
WHO Western Pacific region (WPRO)	396078	41.9	33.4	175061	19.5	13.1	571139	31.0	22.8
IARC membership (24 countries)	231832	17.6	14.6	123667	9.5	6.3	355499	13.6	10.1
Middle-East and Northern Africa (MENA)	13498	5.9	8.3	9365	4.3	5.1	22863	5.1	6.6
Africa	13216	2.5	4.5	10590	2.0	3.2	23806	2.2	3.8
Sub-Saharan Africa	9845	2.3	4.5	8257	1.9	3.4	18102	2.1	3.9
Eastern Africa	4357	2.5	5.2	3679	2.1	3.9	8036	2.3	4.5
Middle Africa	1366	2.1	4.1	1398	2.1	3.9	2764	2.1	4.0
Northern Africa	3371	3.2	4.3	2333	2.2	2.7	5704	2.7	3.4
Southern Africa	1351	4.6	7.2	747	2.5	2.9	2098	3.6	4.7
Western Africa	2771	1.7	3.3	2433	1.5	2.6	5204	1.6	3.0
Latin America and Caribbean	36363	12.2	12.8	24489	8.0	7.1	60852	10.1	9.7
Caribbean	1907	9.1	8.2	1382	6.5	5.1	3289	7.8	6.6
Central America	7224	9.1	10.6	6394	7.9	8.2	13618	8.5	9.3
South America	27232	13.8	14.2	16713	8.2	7.0	43945	11.0	10.3
Northern America	15341	8.9	5.5	9161	5.2	2.7	24502	7.0	4.0
Asia	480364	22.1	22.8	219590	10.6	9.3	699954	16.5	15.8
Eastern Asia	384330	47.0	35.4	168605	21.9	13.8	552935	34.8	24.2
South-Eastern Asia	21311	7.1	8.2	12261	4.0	4.1	33572	5.5	6.0
South-Central Asia	64596	6.9	9.2	31692	3.6	4.2	96288	5.3	6.7
Western Asia	10127	8.1	11.8	7032	6.1	7.3	17159	7.1	9.5
Europe	84226	23.6	13.2	55441	14.4	6.4	139667	18.8	9.4
European Union (EU-28)	50521	20.3	10.1	31071	12.0	4.8	81592	16.1	7.2
Central and Eastern Europe	41082	29.8	20.3	28569	18.3	8.9	69651	23.7	13.5
Northern Europe	7204	14.6	7.4	4460	8.8	3.7	11664	11.6	5.4
Southern Europe	18302	23.6	11.7	12083	15.1	5.9	30385	19.3	8.6
Western Europe	17638	19.0	8.8	10329	10.7	4.3	27967	14.7	6.3
Oceania	1783	9.4	6.8	1030	5.5	3.5	2813	7.5	5.1
Australia/New Zealand	1580	11.6	6.7	862	6.3	3.3	2442	8.9	4.9
Melanesia	165	3.5	7.2	152	3.4	5.2	317	3.5	6.0
Micronesia/Polynesia	38	6.1	7.5	16	2.6	2.8	54	4.4	5.0
Micronesia	7	2.5	3.4	0	0.0	0.0	7	1.3	1.7
Polynesia	31	8.9	10.6	16	4.8	5.1	47	6.9	7.7

TABLE 2. The number, crude and ASMR of GC in different regions of the world in 2012.

Population	Male			Female			All		
	Numbers	Crude Rate	ASR (W)	Numbers	Crude Rate	ASR (W)	Numbers	Crude Rate	ASR (W)
World	468970	13.2	12.7	254103	7.3	5.7	723073	10.2	8.9
More developed regions	106712	17.6	9.2	68044	10.6	4.2	174756	14.0	6.4
Less developed regions	362258	12.3	14.4	186059	6.5	6.5	548317	9.4	10.2
Very High Human Development	89463	15.7	7.9	53858	9.2	3.5	143321	12.4	5.5
High Human Development	70790	13.8	13.4	47005	8.9	6.6	117795	11.3	9.5
Medium Human Development	289333	15.9	17.0	139338	8.0	7.2	428671	12.1	11.8
Low Human Development	19288	2.9	5.4	13844	2.1	3.5	33132	2.5	4.4
WHO Africa region (AFRO)	9556	2.2	4.3	8033	1.8	3.2	17589	2.0	3.7
WHO Americas region (PAHO)	39116	8.3	6.8	26014	5.4	3.7	65130	6.8	5.1
WHO East Mediterranean region (EMRO)	13226	4.2	6.4	7563	2.5	3.5	20789	3.3	4.9
WHO Europe region (EURO)	75132	17.2	10.5	51183	11.0	5.1	126315	14.0	7.4
WHO South-East Asia region (SEARO)	55565	5.9	7.3	27684	3.1	3.3	83249	4.5	5.3
WHO Western Pacific region (WPRO)	276309	29.2	22.8	133588	14.9	9.4	409897	22.2	15.7
IARC membership (24 countries)	148414	11.3	9.2	85911	6.6	4.2	234325	9.0	6.5
Middle-East and Northern Africa (MENA)	11563	5.1	7.2	8086	3.7	4.4	19649	4.4	5.7
Africa	12000	2.2	4.1	9801	1.8	3.0	21801	2.0	3.5
Sub-Saharan Africa	9014	2.1	4.2	7749	1.8	3.2	16763	1.9	3.7
Eastern Africa	4106	2.3	5.0	3462	2.0	3.7	7568	2.1	4.3
Middle Africa	1326	2.0	4.0	1340	2.0	3.8	2666	2.0	4.0
Northern Africa	2986	2.9	3.9	2052	2.0	2.4	5038	2.4	3.1
Southern Africa	945	3.3	5.2	652	2.2	2.5	1597	2.7	3.6
Western Africa	2637	1.6	3.2	2295	1.4	2.5	4932	1.5	2.9
Latin America and Caribbean	30931	10.4	10.8	20504	6.7	5.8	51435	8.5	8.1
Caribbean	1630	7.8	6.8	1116	5.2	4.0	2746	6.5	5.3
Central America	6099	7.7	8.8	5369	6.6	6.7	11468	7.2	7.6
South America	23202	11.7	12.0	14019	6.9	5.7	37221	9.3	8.5
Northern America	8185	4.7	2.8	5510	3.1	1.5	13695	3.9	2.1
Asia	353114	16.2	16.7	173960	8.4	7.1	527074	12.4	11.7
Eastern Asia	266334	32.6	24.0	128282	16.7	9.8	394616	24.9	16.5
South-Eastern Asia	18570	6.2	7.3	10602	3.5	3.5	29172	4.8	5.3
South-Central Asia	59633	6.4	8.5	29042	3.3	3.9	88675	4.9	6.1
Western Asia	8577	6.9	10.2	6034	5.2	6.2	14611	6.1	8.1
Europe	63680	17.8	9.7	43680	11.4	4.6	107360	14.5	6.9
European Union (EU-28)	35393	14.2	6.8	23092	8.9	3.2	58485	11.5	4.8
Central and Eastern Europe	34307	24.9	16.8	23978	15.4	7.1	58285	19.8	10.9
Northern Europe	4930	10.0	4.8	3183	6.2	2.4	8113	8.1	3.5
Southern Europe	13847	17.9	8.3	9260	11.6	4.0	23107	14.7	6.0
Western Europe	10596	11.4	5.1	7259	7.5	2.5	17855	9.4	3.7
Oceania	1060	5.6	3.9	648	3.4	2.1	1708	4.5	3.0
Australia/New Zealand	880	6.5	3.6	495	3.6	1.7	1375	5.0	2.6
Melanesia	149	3.2	6.6	136	3.0	4.7	285	3.1	5.5
Micronesia/Polynesia	31	5.0	6.2	17	2.8	3.0	48	3.9	4.5
Micronesia	7	2.5	3.4	0	0.0	0.0	7	1.3	1.7
Polynesia	24	6.9	8.3	17	5.1	5.4	41	6.0	6.8

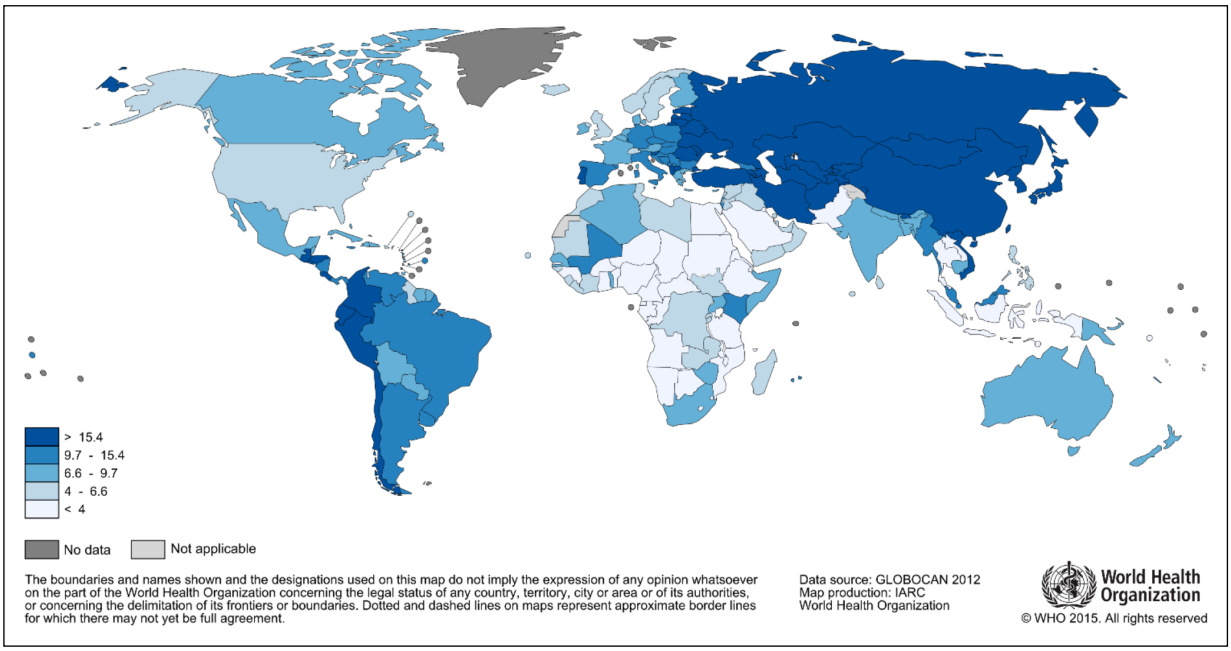

Fig. 1. Distribution of new GC cases in males in the worldwide in 2012.

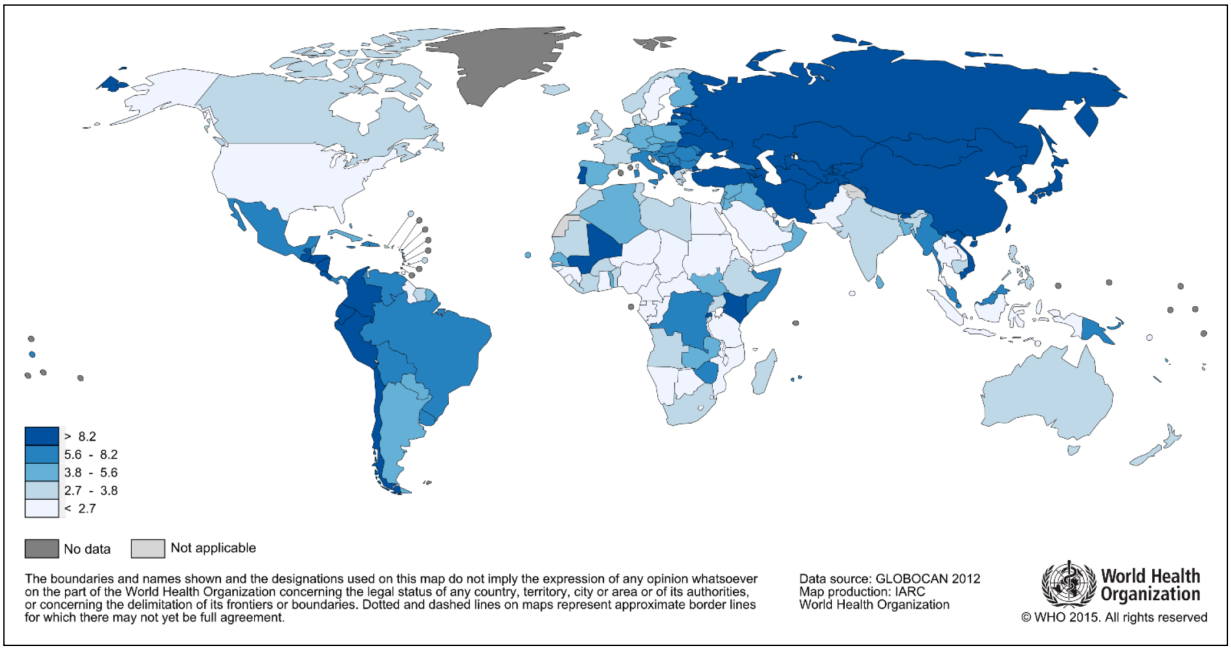

Fig. 2. Distribution of new GC cases in females in the worldwide in 2012.

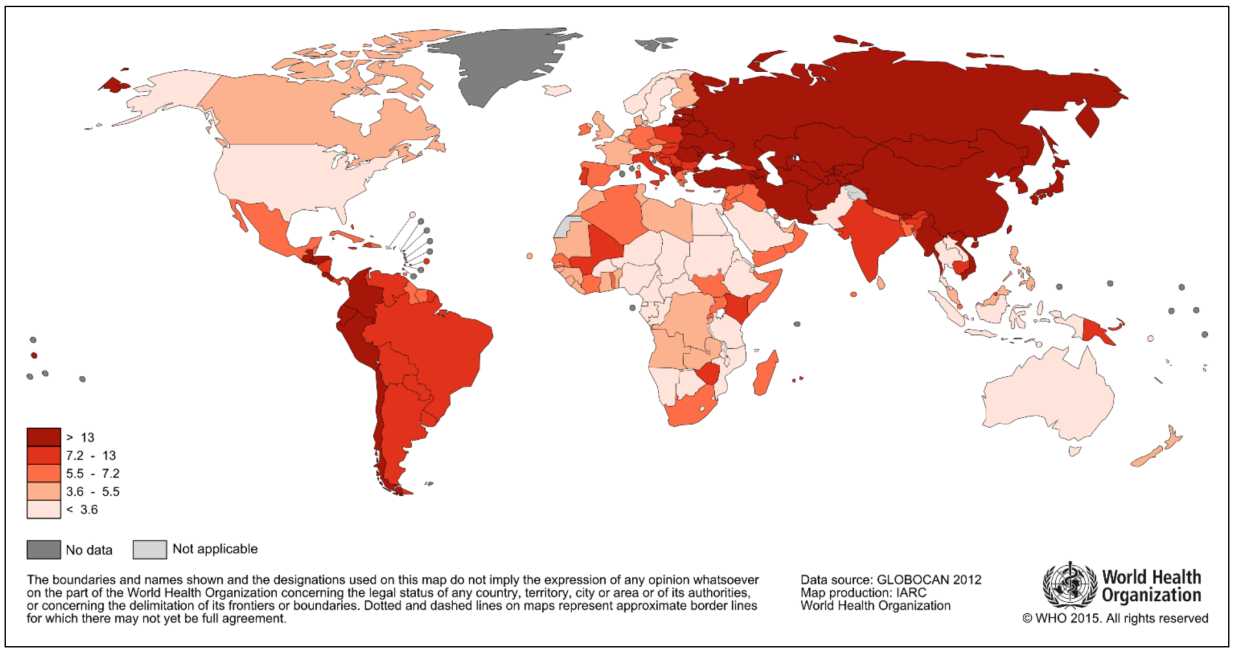

Fig. 3. Distribution of GC mortality in males in the worldwide in 2012.

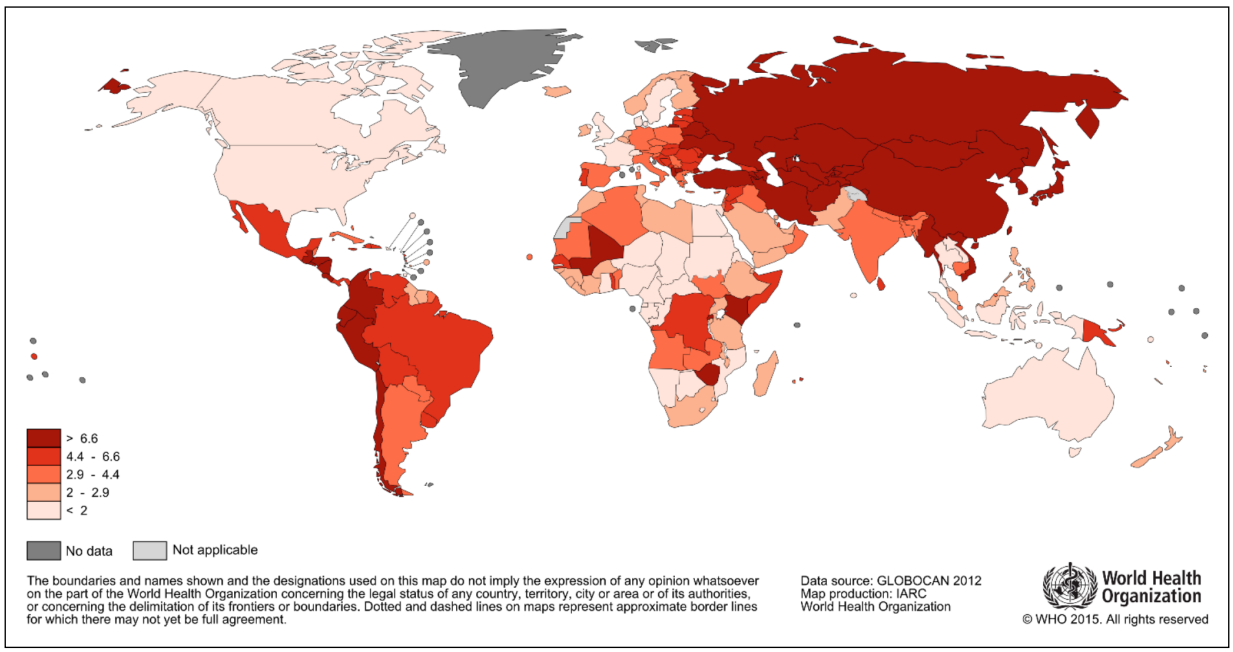

Fig. 4. Distribution of GC mortality in females in the worldwide in 2012.

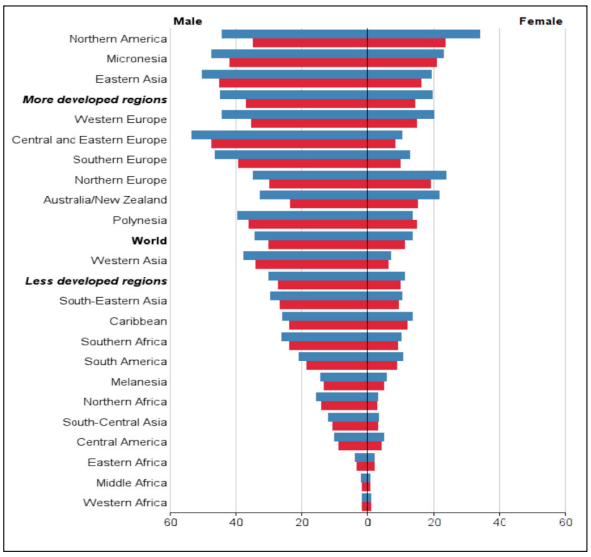

Fig. 5. 20 highest in world areas.

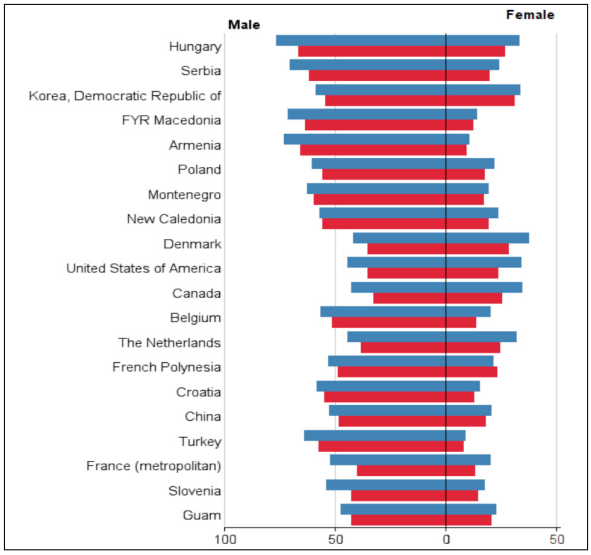

Fig. 6. 20 highest in the world.

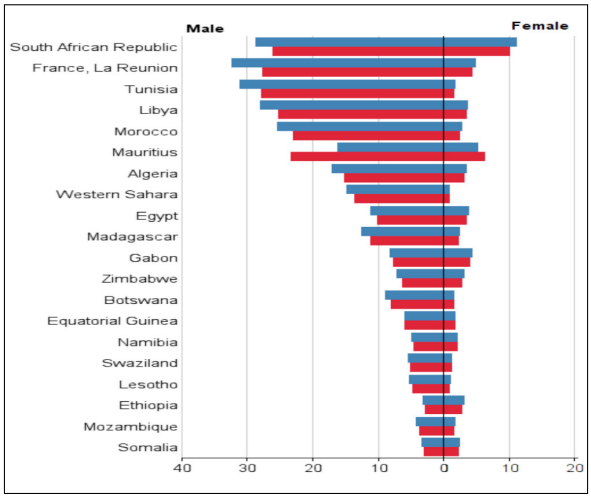

Fig. 7. 20 highest in Africa.

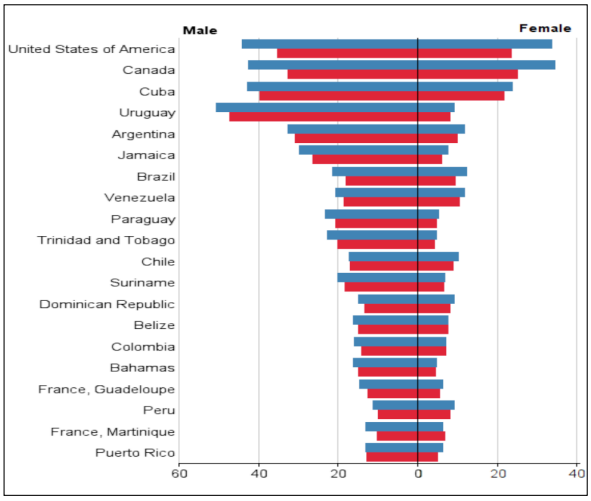

Fig. 8. 20 highest in Americas.

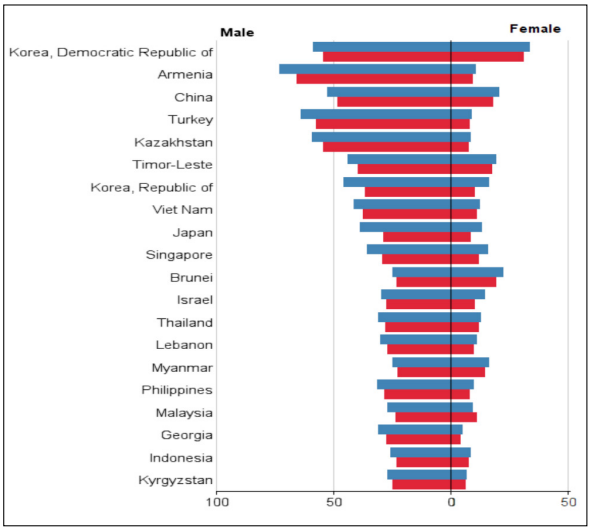

Fig. 9. 20 highest in Asia.

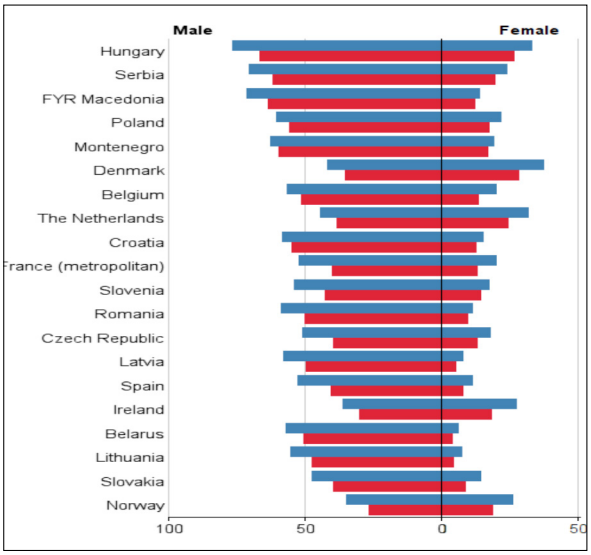

Fig. 10. 20 highest in Europe.

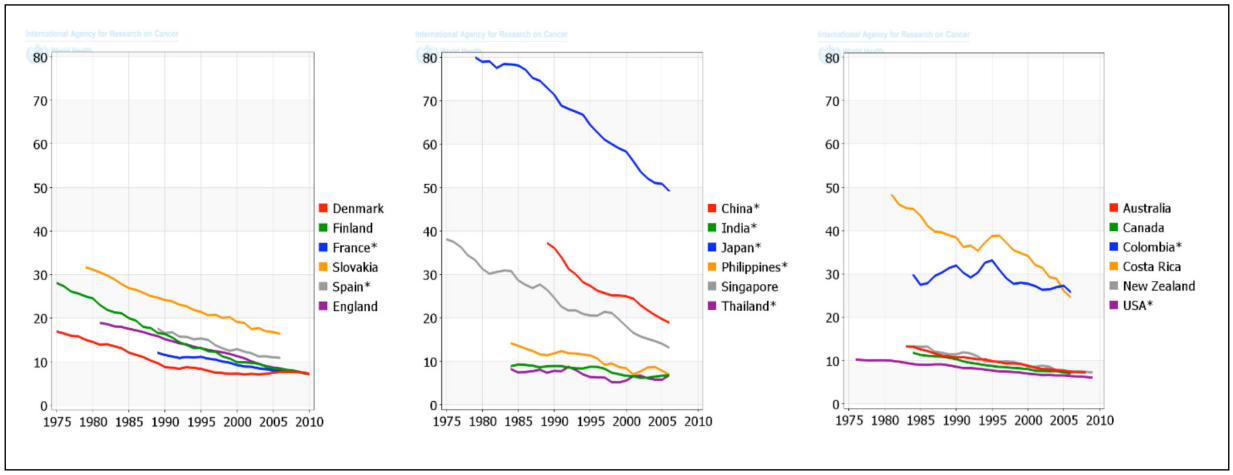

Fig. 11. Trends in incidence of GC in selected countries: age-standardized rate (W) per 100,000, men.

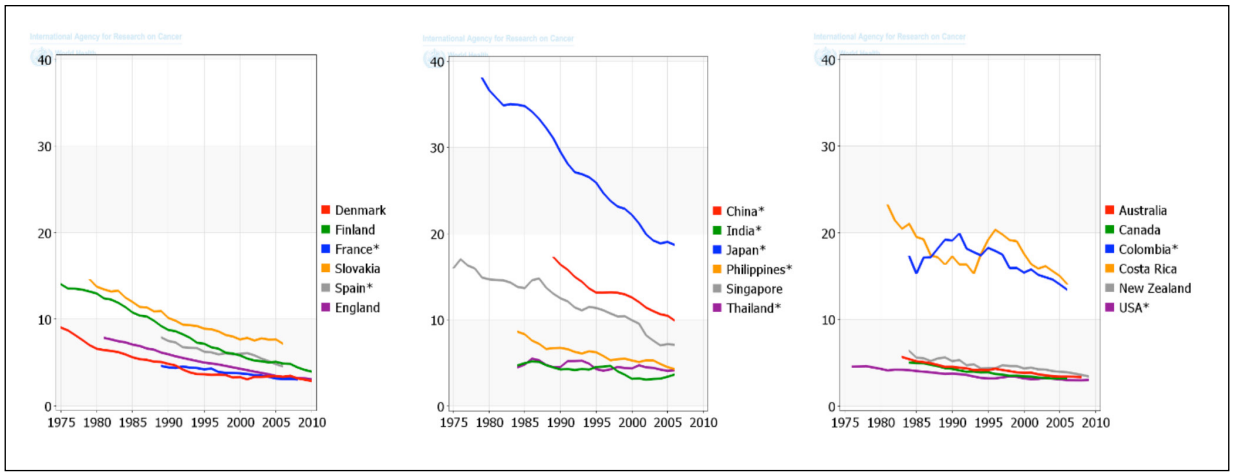

Fig. 12. Trends in incidence of GC in selected countries: age-standardized rate (W) per 100,000, women.

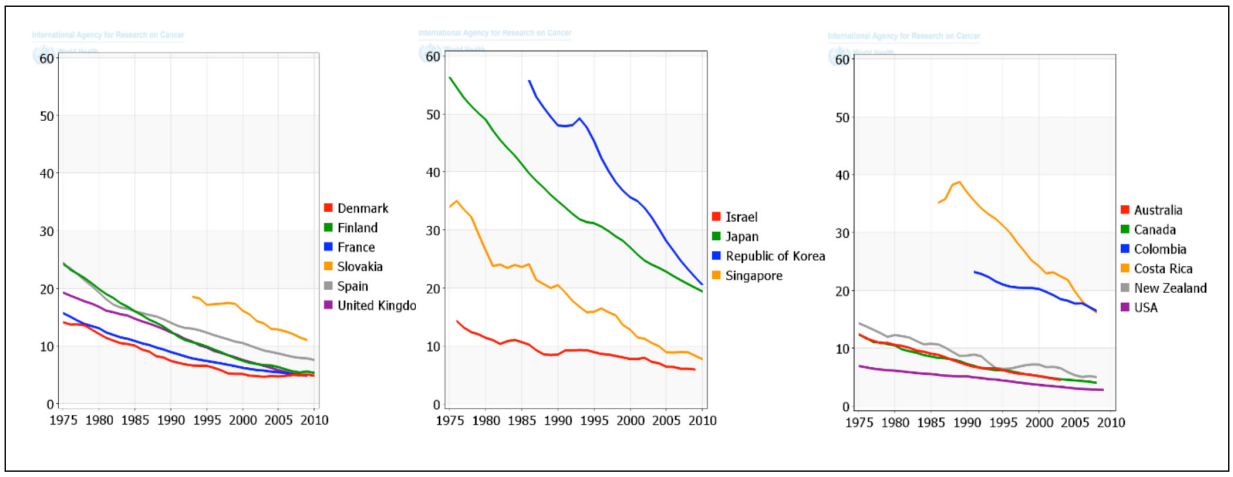

Fig. 13. Trends in mortality from GC in selected countries: age-standardized rate (W) per 100,000, men.

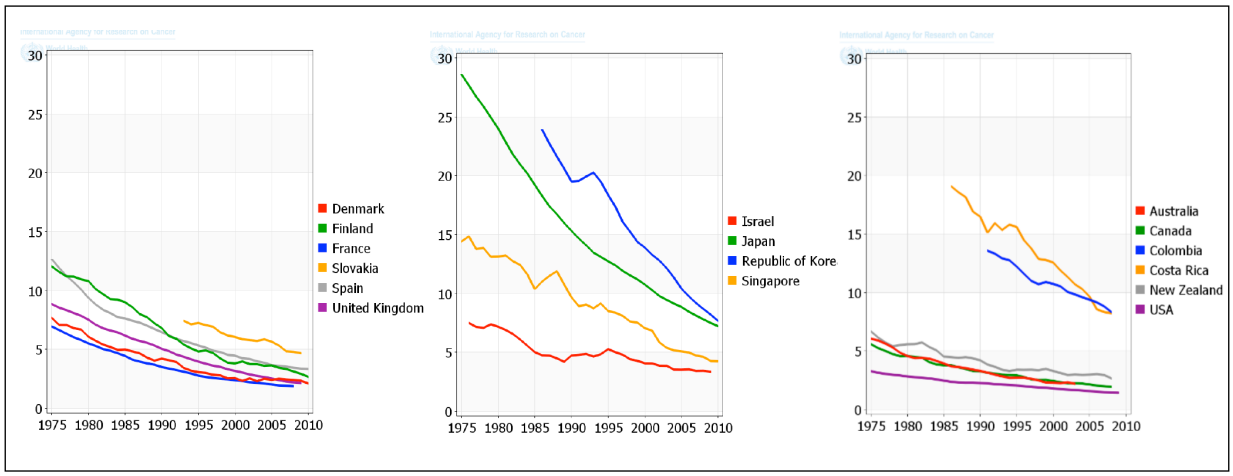

Fig. 14. Trends in mortality from GC in selected countries: age-standardized rate (W) per 100,000, women.

DISCUSSION

The present study aimed to investigate the global distribution and trend of incidence and mortality of GC. We also investigated the incidence and mortality rates of GC in different geographical areas during 2012. In general, 951,594 new cases of GC were diagnosed worldwide in 2012. Men accounted for a higher proportion of new cases as 66.34% of cases were male and 33.66% were female. In 2012, 723,073 deaths from GC were recorded including 64.85% of men and 34.15% of women. The highest incidence and mortality rates of GC were observed in Asia, less developed regions, the WPRO and areas with a medium level of HDI. The incidence and mortality rates of this disease are decreasing in most countries in the world. Various studies [26,27] have investigated the relationships of socioeconomic status and the incidence and mortality rates of cancer. Some studies[28,29] have proved the relationships of incidence and mortality of GC with low socioeconomic status including people with low educational degrees and low-income levels. In the present study, the highest incidence and mortality rates of GC were observed in areas with moderate HDI, but the lowest incidence and mortality in areas with low HDI. The lower incidence and mortality of GC in the areas with low HDI are probably due to the lack of proper diagnosis of disease and problems in recording cancer in these areas. On the other hand, due to the increased consumption of fruits and vegetables, less use of starchy food and low prevalence of *H. pylori* infection in areas with high and very high HDI, the incidence and mortality of GC are less than regions with moderate HDI [8]. However, the GC was ranked first among cancer types in 1975 in terms of the number of its new cases[6]. In 2012, GC was the fifth most common cancer in the world after the lung, breast, Colorectal and prostate cancers. In this year, the GC accounted for 6.8% of the total number of new cases of cancer[30]. More than 70% of newly diagnosed cases of cancer occur in developing countries. Most cases have been reported from Asia, as China, Japan and Korea account for about 60% of all new cases of GC. However, the United States, Africa and the Eastern Mediterranean account for the lowest incidence of GC worldwide[6, 31]. Gastric cancer is ranked third worldwide in terms of mortality, as it caused 723,073 deaths worldwide in 2012 and it accounted for 8.8% of all deaths from cancer. The highest mortality rate of this disease is seen in East Asia where the mortality rate per 100,000 people is equal to 24 for men and 9.8 for women. The lowest mortality rate of this disease can be seen in North America, so that the mortality rate per 100,000 people is 2.8 in men and 1.5 in women[2,6,8,31]. The incidence of GC (noncardia gastric adenocarcinoma (NCGA)) has been steadily declining over the past years. However, there are significant differences in the model of reduction in the incidence of this disease among different countries. Since 1950, the incidence of GC has been reduced by more than 80% in the United States, but it has been decreasing at a lower speed in Asian countries such as China, Japan and Korea, which have the highest number of cases of disease[32]. The reasons for reduced incidence and mortality of GC worldwide are completely vague, but the widespread use of refrigerator and increased access to fresh fruits and vegetables, and less use of salted foods, the public health improvement, screening programs especially in high risk countries, reduced rate of cigarette smoking and use of antibiotics and reducing the prevalence of *H. pylori* can be considered as effective factors in reducing the incidence of this disease[6,31,33,34]. Despite the fact that the incidence of GC has been declining over the last few decades, this decline is often due to a decrease in the incidence of NCGA. According

to a number of studies, the incidence of gastric cardia cancer has been ascending in countries like the United States and some European countries. It seems that this increase in the incidence of gastric cardia cancer is associated with diseases that lead to Gastroesophageal reflux disease (GERD). Furthermore, an increase in the prevalence of gastroesophageal reflux diseases is associated with an increase in the prevalence of obesity in these regions. The improvement of methods for diagnosis and differentiation of gastric cardia cancer from adenocarcinoma of esophagus is another reason for increased incidence of gastric cardiac cancer[6]. The present study investigated the geographical distribution of the incidence and mortality of GC in different geographical regions worldwide. Nevertheless, the study on the epidemiology of diseases aims to obtain appropriate and useful information for policy making and health planning with the aim to reduce the incidence and mortality of the diseases. Prevention of GC is possible at three levels of disease prevention. The primary prevention aims to reduce the exposure to detected risk factors or increase the individual resistance to risk factors. We can expect that the incidence of GC decreases by applying the appropriate measures to reduce the public exposure to changeable risk factors of disease. Therefore, the use of educational programs to raise the public awareness about the risk factors of the disease can be effective and useful[35]. The secondary prevention aims at quick diagnosis of cases and timely treatment of patients. At this level of prevention, it is useful to perform screening programs for timely diagnosis of pre-clinical symptoms. These programs ultimately lead to the diagnosis of cases at the early stages of cancer and before the spread or deterioration of disease. This level of prevention can reduce the mortality from diseases at the social level[33, 34, 36]. The tertiary prevention aims to perform necessary interventions and assistance such as providing rehabilitation services for patients, so that patients can appropriately use their potential and become useful for themselves, family and the community[33,34,36]. Accordingly, the eradication of *H. pylori*, lifestyle modification such as smoking cessation and weight loss, early diagnosis of disease and timely treatment of patients, and appropriate care programs for pre-malignant lesions are effective and practical measures to reduce the incidence and mortality of GC[37]. The eradication of *H. pylori* is very important in this regard. Global estimates suggest that 75% of GC cases are attributable to *H. pylori*. Therefore, more than 650,000 cases of GC per year are attributable to *H. pylori*. Hence, the eradication of *H. pylori* can have a very significant effect on reducing the incidence of GC[37, 38]. Appropriate information on the distribution of this disease is necessary to take appropriate measures to prevent the incidence and mortality of GC. The present study indicated the epidemiological face and geographical distribution of the incidence and mortality of GC based on the continents, development level, WHO classification, and the human development index (HDI) level. Therefore, it is expected that the obtained results will be useful in adopting global and regional measures to reduce the incidence and mortality of GC. Since the applied information in GLOBOCAN is collected from 185 countries around the world and the data collection method has not been the same in all of these countries, it should be noted in interpreting the results of GLOBOCAN data that the validity and reliability of data is not exactly equal and comparable across countries and regions of the world. However, our data provide useful and complete information on the distribution of incidence and mortality of cancers, and can be useful in health planning and policy making[30].

CONCLUSIONS

The highest incidence and mortality of GC were observed in Asia, less developed regions, and the WPRO and those areas with medium levels of human development index. The incidence and mortality rates of GC were decreasing in both genders and most regions worldwide.

Author Contributions:
All authors contributed to the design of the research. MM, HS, AS, FAB and AMH extracted the data and summarized it. All authors drafted the first version. HSG, AS and AMH edited the first draft. All authors reviewed, commented and approved the final draft.

Conflict of Interest:
The Authors declare that have no conflicts of interest to disclose.

Ethical Committee:
Ethical Committee is not required for this study.

Informed Consent:
Informed Consent is not required for this study.

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