A Diversity of Cancer Incidence and Mortality in West Asian Populations

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ABSTRACT

Background: Western Asia comprises a large proportion of the world population with different ethnicities and religions inhabiting areas of diverse geographic features. The countries of this region have experienced rapid economic growth over the latter half of the 20th century, which continues to this day, resulting in major changes in lifestyle of the population.

Objectives: The aim of this study was to compare the incidence and mortality of cancer in West Asia using the estimates reported by the International Agency for Research on Cancer (IARC) in Globocan-2012.

Methods: Countries with high-quality data or national data (based on the definition of the Globocan-2012) were included in the analysis. These included Bahrain, Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, and Turkey. We also found high-quality cancer data from regional cancer registries in 3 Iranian and 3 Turkish provinces. Data on cancer incidence and mortality were collected and described in tables and graphs. Spearman's correlation test was used to assess the correlation between geographic coordinates and the incidence age-standardized rate (ASR; per 100,000 person-years) of cancers.

Findings: Nine countries and 6 regional registries were included. Cancers of the lung (ASR, 33.3), prostate (24.9), bladder (19.1), stomach (16.5), and colorectal (15.9) were the most common malignancies in men. The most common cancers in women were those of the breast (35.4), colorectal (12.1), thyroid (10.3), stomach (9.2), and lung (6.7). The incidence rates of upper gastrointestinal and lung cancers were considerably higher in the northern part of this region, including Turkey and northern Iran compared with southern countries. High incidences of breast, colorectal, prostate, and bladder cancers were found in countries located in the northwest including Jordan, Lebanon, and Turkey.

Conclusions: The most common cancers differed by country. Consequently, cancer control programs must be tailored to the most common types of cancers in each country. Lack of high-quality data for some West Asian countries was the major limitation of this study. Therefore, as the first step of cancer control programs, it is recommended that well-structured population-based cancer registries be established in all of these countries.

Key Words: cancer, diversity, incidence, mortality, West Asia

INTRODUCTION

Along with improvement of hygiene and the subsidence of infectious diseases, cancers have emerged as the leading cause of death in the developed world and the second most common cause of death in developing countries. It is expected that cancers continue to hold this dominant position as the population of the world continues to age gradually and lifestyle-related factors (tobacco use, sedentary lifestyle, unhealthy diets, etc.) prevail. According to the last report of the Globocan project, there were 14.1 million new cancer cases, 8.2 million cancer deaths, and 32.6 million individuals living with cancer worldwide in 2012.[1] Eight million (57%) new cancer cases, 5.3 million (65%) cancer deaths, and 15.6 million (48%) of the 5-year prevalent cancer cases occurred in the less-developed regions.[1] In other words, the developing world is bearing more than half of the worldwide cancer burden.

West Asia comprises a multitude of low- and middle-income countries (LMICs). It is home to a large proportion of the world population with different ethnicities and religions inhabiting areas of diverse geographic features. The countries of this region experienced rapid economic growth over the latter half of the

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20th century, which continues to this day, resulting in major changes in lifestyle of the population. In this study, we aim to compare the incidence and mortality of cancer in West Asia using the estimates reported by the International Agency for Research on Cancer (IARC).[1]

METHODS

Sources of Cancer Data

We mainly used the Globocan-2012 data for analyzing cancer incidence, prevalence, and mortality.[1] Only countries with high-quality data or national data (categories A, B, C, and D of the Globocan-2012 classification) were included. The quality of data in Globocan-2012 was assessed and classified according to the indices of data quality used in the *Cancer in Five Continents X*.[2] These included the percentage of cases microscopically verified (MV%), the percentage of cases registered from a death certificate only (DCO%), the proportion of unknown basis of diagnosis (UB%), and the ratio of the number of deaths from a particular cancer to the number of cases registered during the same period (MI%). We also explored the *Cancer in Five Continents X* website[2] to find cancer data from high-quality regional or provincial cancer registries (according to the aforementioned criteria) from this region.

Selected Countries

We aimed to analysis cancer data from countries in West Asia. High-quality data or national data were available for only 9 of the West Asian countries in Globocan-2012, including Bahrain, Iran, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, and Turkey.[1] Cancer data from these countries were collected and included in our final analysis (Fig. 1).

Regional Registries

High-quality cancer data was found from regional cancer registries in 6 provinces of Iran and Turkey. These included Golestan (Northeast), Ardabil (Northwest), and Kerman (South) provinces of Iran, as well as Trabzon (Northeast), Edirne (Northwest), and Antalya (South) in Turkey (Fig. 1).

Statistical Analysis

Data on the incidence age-standardized rate (ASR; per 100,000 person-years), 5-year prevalence of cancers (proportion per 100,000), as well as the ASR and cumulative risk (%, age 0-74) of cancer mortality were collected. The pooled ASRs of cancers for all 9 included countries were extracted from the Globocan-2012 data set[1] Using the pooled ASRs, we identified the most common cancers in West Asian men and women. Considering the historical importance of esophageal cancer in northern Iran,[3,4] the distribution of esophageal cancer also was presented. Tables and graphs were created to describe the data.

To show the geographic distribution of cancers in graphs, the countries and provinces were ordered according to their geographic latitude and longitude.

Spearman's correlation test was used to assess the correlation between geographic coordinates and the ASRs of cancers. $P < .05$ was considered significant.

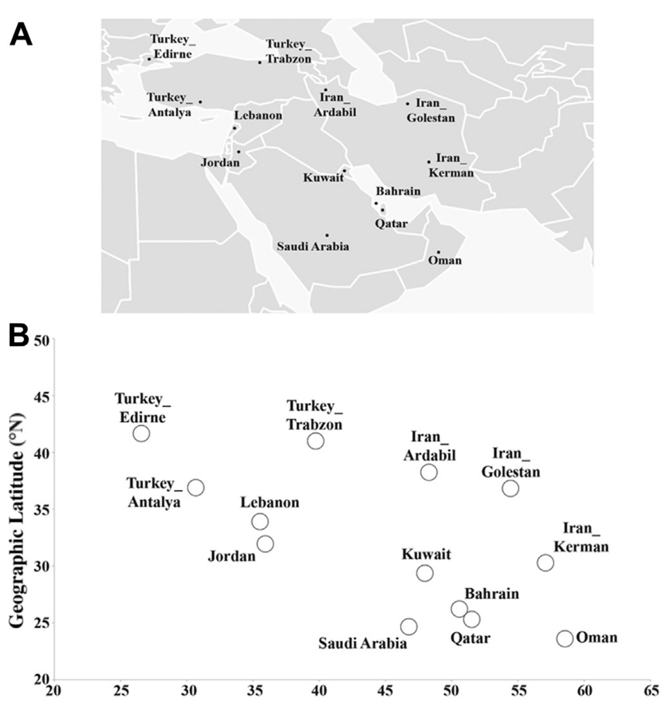

Figure 1. West Asian countries for which high-quality or national data on cancers was available in the Globocan-2012 project, presented as a (A) map and (B) graph.

Table 1. Incidence ASR (per 100,000 person-years) and 5-y prevalence (P) (proportion per 100,000) of Cancers Incidence in West Asia, Male

	Bahrain		Iran		Jordan		Kuwait		Lebanon		Oman		Qatar		Saudi Arabia		Turkey		Pooled	
	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P
Lip, oral cavity	3.2	4.2	2.2	5.7	2.2	4.7	1.5	4.1	2.6	7.1	1.9	4	2	4.8	2	3.9	2.7	7.5	2.4	6
Nasopharynx	0.2	1.1	0.8	2.6	1.3	3.2	0.4	1.5	1.1	3.7	0.5	1.5	0.8	2.2	1.7	4.9	1.6	5.6	1.2	4
Other pharynx	0.8	0	0.4	1	0.3	0.8	0.1	0.2	0.5	1.5	0.5	1.1	0.7	0.5	0.4	0.8	0.9	2.7	0.6	1.6
Esophagus	2.2	1	9	8.7	1.2	1	0.7	0.8	0.9	1	1.8	1	1.8	0.9	1.4	0.9	4.3	4.6	5.6	5.2
Stomach	4.5	3.5	20.6	27.9	6.5	8.1	2.8	4.6	6.5	11	6.4	5.1	6	5.6	3.8	3.8	17.9	27.6	16.5	21.9
Colorectal	11.8	18.8	11.6	27.5	29.8	55.9	12.6	26.7	19.1	55.1	7.4	14.1	11.6	19.6	12.6	22.1	20.5	54.7	15.9	37.3
Liver	3.6	1.4	2.8	1.7	5.4	2.7	5.3	3.6	3.3	2.5	4.6	2	8.9	3.9	6.4	2.6	4.7	3.3	4.1	2.5
Gallbladder	0.8	0.8	1	1.3	1.8	1.9	1.1	1.1	1.3	1.9	0.6	0.5	1.9	1.2	1.2	1	2.3	3.1	1.6	1.9
Pancreas	3.1	1.3	2.1	1.5	5	3.2	3.2	1.7	3.5	3.1	2.5	1.3	2.8	0.9	2.6	1.3	6.1	5.2	3.9	2.8
Larynx	3.3	4.5	3.8	10.5	6	14	2.1	4.3	6.6	22.3	1.4	2.5	2.7	3.6	1.4	2.9	7.9	25.9	5.3	14.8
Lung	21.3	7.6	10.3	9.2	27	19.8	9.9	7.6	30.2	33.1	6.7	3.8	13.4	7	7.3	4.6	63.9	65.8	33.3	29.3
Melanoma of skin	0.5	0	0.9	2.4	0.4	1.7	0.1	0.2	1	3.7	0.4	0.4	0.6	1.1	0.3	0.6	2.1	7.3	1.3	3.8
Kaposi sarcoma	0.1	0.3	0.2	0.5	0.4	0.7	0	0	0.3	1	0.1	0.3	0.6	1	0.4	0.7	0.5	1.2	0.3	0.8
Prostate	13.5	14.6	12.6	34.8	15.3	34.1	14.5	28.2	37.2	129.7	10.2	14.7	13.2	10.4	9.5	15.5	40.6	117.2	24.9	62.2
Testis	1.3	6.4	1.7	7.6	1.7	10.1	0.6	4.1	2.4	15.5	0.4	2.1	0.5	4.5	0.6	3.1	3.2	18	2	10.7
Kidney	2.7	4.7	3	6.9	4.3	9.1	2.6	5.4	4.8	13.7	2.1	3	4.4	7.6	2.8	5.5	6.8	18.2	4.6	10.8
Bladder	9.6	12.7	13.2	36.8	12.3	28.3	7.1	16.2	29.1	100.6	6.7	11.4	6.7	8	5.7	11.6	28.7	88.3	19.1	51
Brain, nervous system	3.6	3.8	4.6	9.4	4.3	6.4	1.9	2.9	5	9	2.2	2.8	2.4	4	2.2	2.6	5.8	10.6	4.6	8.4
Thyroid	1.2	2.8	1.4	6.4	1.9	8	1.5	6.9	2.3	11	1	4.1	1.1	1.8	1.7	6.9	3.8	19.3	2.4	11.1
Hodgkin lymphoma	1.4	2.5	1.6	6.2	2.3	8	1.5	6.5	4.2	17.8	1.3	5.3	1.5	4.1	1.8	6.1	2.8	10.8	2.2	8
Non-Hodgkin lymphoma	4.7	6.5	5.7	10.5	5.8	10.7	7.6	18.2	14.7	31.8	6.2	9.3	5.9	9	6.5	9.4	8.3	16.5	7	13
Multiple myeloma	1.6	1.1	2	3.1	3.2	4.6	1.6	2.4	2.3	4.4	1.4	1.8	2.3	2.1	1.1	1.4	3.3	6.3	2.4	4
Leukemia	5.1	3.1	6.9	7.7	7.8	7.8	6.8	8.7	8.5	10.5	5.1	4.7	5.2	7.1	4.2	3.9	7.1	8.3	6.6	7.3
All cancers excluding nonmelanoma skin cancer	112.8	118.8	134.7	267.8	153.3	259.3	89.8	165.6	203.9	533.1	78.6	108.1	104	123.9	85.9	130.7	257.8	557.7	181	347.6

ASR, age-standardized rates.

Table 2. Incidence ASR (per 100,000 person-years) and 5-y prevalence (P) (proportion per 100,000) of Cancer Incidence in West Asia, Female

	Bahrain		Iran		Jordan		Kuwait		Lebanon		Oman		Qatar		Saudi Arabia		Turkey		Pooled	
	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P	ASR	P
Lip, oral cavity	1.2	0	1.8	4.7	1.2	3.4	1.3	4.1	1.5	4.4	1.7	3	1.9	0	2.1	4.3	1.5	4.3	1.6	4.3
Nasopharynx	0.2	0.8	0.4	1.4	0.8	2.1	0.6	1	0.3	1.4	0.2	0.5	0.3	1.5	0.9	2.6	0.5	1.7	0.5	1.7
Other pharynx	0	0	0.3	0.7	0.3	0.6	0	0	0.2	0.7	0.1	0.5	0	0	0.4	0.9	0.2	0.7	0.3	0.7
Esophagus	1.3	1.6	8	7.7	0.6	0.5	0.9	0.8	0.6	0.8	1.2	0.7	3	1.5	1.4	1	3	3.7	4.5	4.8
Stomach	3.1	3.5	9.7	13.2	5.3	7.2	2.1	3.8	4.7	9.1	3.9	3.8	5.6	6.8	2.4	2.9	10.9	19.1	9.2	13.7
Colorectal	11	23.7	10.5	25.2	21.2	44.8	13.3	30.9	13.5	43.4	7.6	13.4	15.5	34.3	10.8	22.5	13.1	38.2	12.1	30.9
Liver	3.4	1.3	2.1	1.3	3	1.4	1.9	1.1	1.9	1.6	2.8	1.1	5	1.8	2.8	1.4	1.8	1.4	2.1	1.4
Gallbladder	0.9	0	1.4	1.6	3.1	3.3	1.3	1.4	1.8	3	0.8	0.6	2.7	1.8	2.8	2.6	1.3	1.9	1.6	1.9
Pancreas	3	1.3	1.6	1.2	3.4	2.2	2.7	1.3	2.7	2.5	1.8	1	0.6	0.6	2.2	1.2	3.1	2.8	2.4	1.9
Larynx	0	0	0.6	1.7	0.7	1.9	0.5	1	1.2	4	0.3	1.2	0	0	0.2	0.4	0.5	1.7	0.5	1.6
Lung	8.5	4.3	5	4.5	4.1	3.1	4.8	3.6	11	13.3	2.8	1.7	4.1	3.8	2.7	2	8.8	10	6.7	6.5
Melanoma of skin	0	0	0.7	1.8	0.6	1.7	0	0	1.2	4.8	0.4	0	0.2	0.9	0.3	0.9	2.1	7.5	1.3	4
Kaposi sarcoma	0	0	0.1	0.2	0.2	0.3	0	0	0.1	0.2	0.2	0.2	0	0	0.2	0.3	0.2	0.5	0.1	0.4
Breast	42.5	168.1	28.1	118.1	61	212.9	46.7	164.4	78.7	391.7	26	82.3	46.1	183.8	29.5	113.8	39.1	187	35.4	154.3
Cervix uteri	5.9	17.1	2.8	9.1	2.4	7.3	4	15.5	4.6	18.6	5.3	12.6	5.1	18.6	2.7	8.1	4.3	16.7	3.5	12.3
Corpus uteri	4.7	14.1	2.5	10.1	5.2	16.7	7.5	20.4	7.7	39.4	3.8	10.1	5.7	16.3	5.8	18.2	10.1	49.9	6.5	27.7
Ovary	4.4	9.6	4.8	14.1	5.4	13	4.7	13.1	7.5	25.6	3.3	7.5	4.6	13	3.4	8.4	6.3	20.8	5.4	16.1
Kidney	2.5	5.6	2.1	4.9	2	4	1.5	2.9	1.8	5.7	2.1	2.5	1.5	5.3	1.8	3.8	4.4	12.6	3.1	7.7
Bladder	2.1	4.5	3.4	9.4	1.8	4.2	2.7	5.8	6.1	24	2.3	4.4	1.9	1.8	1.2	2.8	3.5	12	3.3	9.6
Brain, nervous system	1.8	3.7	3.8	7.4	3.4	5.8	1.5	2.5	3.1	5.9	1.7	2	2.6	5.3	1.9	2.5	6.4	12.1	4.6	8.4
Thyroid	4.1	17.6	4	19.9	7.2	34	6.5	32.4	6.3	34.9	5.2	25.1	6.5	33.4	7.5	38.7	17.8	95.5	10.3	52.7
Hodgkin lymphoma	0.6	0.8	1.1	4.3	2.3	10.3	1.3	7.9	3.2	13.2	1.5	3.6	1.2	8	1.4	4.8	1.4	5.2	1.4	5.1
Non-Hodgkin lymphoma	3.5	5.3	3.8	7	6	10.3	3.4	9	11.5	26.5	5.7	8.1	7	15.4	6.1	9.6	5.5	11.4	5.1	9.6
Multiple myeloma	1.6	1.9	1.2	2.2	1.9	2.6	1.3	2.4	2.1	4.7	1	1.2	1	0	0.9	1.2	2.6	5.4	1.9	3.4
Leukemia	4.6	5.1	4.7	5.6	4.3	4.8	6.2	8.4	5.6	7.4	4.7	3.9	3.8	5.9	3.5	3.9	4.7	5.3	4.6	5.3
All cancers excluding nonmelanoma skin cancer	121.9	308	120.1	312.8	157.8	420.5	123.3	348	192.8	725.7	92.4	199.6	134.5	378	102.8	274.7	161.6	549.5	139.2	412.9

ASR, age-standardized rates.

Table 3. Incidence ASR (per 100,000 person-years) and CR (0-74; %) of Cancer Mortality in West Asia, Male

	Bahrain		Iran		Jordan		Kuwait		Lebanon		Oman		Qatar		Saudi Arabia		Turkey		Pooled	
	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR
Lip, oral cavity	0.5	0.06	0.7	0.08	0.7	0.05	0.3	0.03	0.8	0.09	0.6	0.07	0.5	0.06	0.6	0.07	0.9	0.11	0.8	0.09
Nasopharynx	0.1	0.02	0.4	0.05	0.7	0.07	0.1	0.02	0.5	0.05	0.3	0.04	0.6	0.12	0.9	0.11	0.9	0.1	0.7	0.08
Other pharynx	0.5	0.08	0.3	0.03	0.3	0.02	0	0	0.3	0.04	0.4	0.05	0.6	0.1	0.3	0.03	0.7	0.08	0.4	0.05
Esophagus	1.4	0.06	8.2	0.95	1.1	0.16	0.9	0.1	0.9	0.11	1.8	0.21	1.8	0.15	1.4	0.14	4	0.47	5.2	0.59
Stomach	3.9	0.45	17.3	1.93	5.6	0.63	1.5	0.19	5.2	0.59	5.8	0.74	5.4	0.75	3.3	0.38	15.5	1.83	14.2	1.61
Colorectal	3.2	0.6	6.9	0.79	17.9	2.1	5.6	0.71	10.5	1.17	4.8	0.49	6.6	0.83	7.3	0.89	12.6	1.47	9.6	1.13
Liver	5.6	0.96	2.6	0.3	5.2	0.65	5.1	0.67	3.1	0.35	4.6	0.49	9.5	1.29	6.2	0.77	4.5	0.55	3.9	0.48
Gallbladder	0	0	0.9	0.11	1.7	0.21	0.4	0.03	1.3	0.15	0.6	0.06	1.8	0.24	1.1	0.13	2.2	0.27	1.5	0.18
Pancreas	3	0.29	2	0.25	5	0.59	3.1	0.45	3.3	0.41	2.7	0.22	2.8	0.37	2.6	0.34	6	0.73	3.8	0.48
Larynx	1.8	0.17	1.5	0.19	2.5	0.29	1	0.19	2.4	0.29	0.5	0.06	0.8	0.04	0.5	0.07	3.3	0.41	2.2	0.27
Lung	16.5	1.8	9.1	1.05	24.1	2.85	8.3	1.09	26.9	3.21	6.1	0.7	12.7	1.89	6.7	0.85	57.5	6.91	29.9	3.69
Melanoma of skin	0.1	0.02	0.3	0.03	0.2	0.01	0	0	0.3	0.02	0.2	0.04	0	0	0.1	0.01	0.9	0.11	0.5	0.06
Kaposi sarcoma	0	0	0.1	0.01	0.1	0.01	0	0	0.1	0.01	0.1	0.01	0.5	0	0.2	0.02	0.2	0.02	0.2	0.02
Prostate	6.5	0.6	6.2	0.49	8.3	0.78	3	0.27	17.1	1.38	6.3	0.57	6	0.61	4.8	0.47	22.8	2.24	13.2	1.3
Testis	0	0	0.7	0.06	0.8	0.06	0	0	0.7	0.04	0.2	0.01	0	0	0.2	0.02	1.3	0.11	0.8	0.07
Kidney	1.5	0.19	2	0.23	2.9	0.32	1.2	0.16	3	0.34	1.5	0.18	2.8	0.38	1.8	0.2	4.7	0.54	3.1	0.36
Bladder	3.9	0.4	5.5	0.59	5.5	0.6	2.5	0.3	11	1.18	3.4	0.42	2.4	0.25	2.3	0.27	12.8	1.51	8.3	0.97
Brain, nervous system	1.4	0.14	3	0.31	2.7	0.29	2.3	0.3	2.8	0.29	1.5	0.17	1.6	0.26	1.2	0.12	3.6	0.37	2.9	0.31
Thyroid	0	0	0.5	0.05	0.8	0.08	0	0	0.6	0.05	0.6	0.13	0.4	0.1	0.9	0.1	0.8	0.11	0.7	0.08
Hodgkin lymphoma	0.1	0.01	0.8	0.08	1.4	0.15	0	0	1.9	0.2	0.7	0.08	0.3	0.03	0.9	0.09	1.5	0.16	1.1	0.12
Non-Hodgkin lymphoma	0.3	0.02	3.6	0.39	3.8	0.43	2.1	0.25	8.6	0.96	4.5	0.56	4.2	0.6	4.3	0.48	5.3	0.6	4.5	0.5
Multiple myeloma	0.7	0.03	1.6	0.2	2.6	0.32	0.6	0.07	1.7	0.21	1.3	0.13	2.2	0.39	0.9	0.12	2.6	0.33	1.9	0.25
Leukemia	2.6	0.22	5.4	0.56	6.5	0.67	3	0.31	6.3	0.62	4.3	0.35	3.7	0.27	3.1	0.3	5.8	0.58	5.3	0.53
All cancers excluding nonmelanoma skin cancer	60.9	6.61	90.4	9.38	105.2	11.25	46.4	5.69	119.5	12.05	57.8	6.2	71.8	8.79	56.8	6.33	179	18.93	123.6	13.32

ASR, age-standardized rates; CR, cumulative risk.

Table 4. Incidence ASR (per 100,000 person-years) and CR (0-74; %) of Cancer Mortality in West Asia, Female

	Bahrain		Iran		Jordan		Kuwait		Lebanon		Oman		Qatar		Saudi Arabia		Turkey		Pooled	
	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR	ASR	CR
Lip, oral cavity	0.2	0.03	0.6	0.07	0.4	0.04	0.7	0.08	0.4	0.05	0.1	0	0	0	0.6	0.07	0.5	0.06	0.5	0.06
Nasopharynx	0	0	0.2	0.03	0.5	0.06	0	0	0.1	0.01	0.1	0.01	0	0	0.5	0.05	0.3	0.03	0.3	0.03
Other pharynx	0	0	0.2	0.03	0.3	0.02	0.2	0	0.2	0.02	0.1	0	0	0	0.3	0.03	0.2	0.02	0.2	0.02
Esophagus	0.2	0.03	7.4	0.88	0.6	0.07	1.2	0.07	0.6	0.04	1.2	0.14	3	0.37	1.3	0.15	2.7	0.31	4.2	0.49
Stomach	2.9	0.24	8.3	0.94	4.5	0.5	1.7	0.18	3.8	0.41	3.4	0.41	4.5	0.58	2.1	0.23	9.3	1.07	7.8	0.9
Colorectal	5	0.61	6.3	0.74	13	1.5	8.6	0.93	7.4	0.83	4.7	0.55	9.7	1.11	6.1	0.71	7.8	0.89	7.2	0.83
Liver	3.4	0.44	2	0.22	2.9	0.34	4.2	0.54	1.7	0.19	2.8	0.31	5	0.72	2.7	0.33	1.7	0.19	2	0.22
Gallbladder	0.5	0.12	1.3	0.16	2.8	0.32	1.4	0.19	1.6	0.19	0.8	0.09	2.7	0.48	2.7	0.32	1.3	0.15	1.5	0.17
Pancreas	2.4	0.31	1.6	0.18	3.3	0.43	3.9	0.47	2.6	0.34	1.8	0.16	0.6	0.07	2.2	0.27	2.9	0.36	2.4	0.29
Larynx	0	0	0.2	0.03	0.3	0.04	0.1	0	0.4	0.05	0	0	0	0	0.1	0.01	0.2	0.02	0.2	0.02
Lung	7.6	0.98	4.5	0.52	3.7	0.44	3.4	0.32	9.6	1.13	2.8	0.33	4.1	0.46	2.5	0.3	7.8	0.93	6	0.71
Melanoma of skin	0	0	0.3	0.03	0.3	0.03	0	0	0.4	0.03	0	0	0	0	0.1	0.01	0.8	0.09	0.5	0.06
Kaposi sarcoma	0	0	0	0	0.1	0.01	0	0	0	0.01	0	0	0	0	0	0.01	0.1	0.01	0.1	0.01
Breast	11.1	1.19	9.9	1.08	21.8	2.44	17.3	2.13	24	2.63	9.5	1.06	11.2	1.26	9.1	1	13.4	1.47	12.1	1.34
Cervix uteri	1.9	0.27	1.2	0.14	1	0.1	2.1	0.31	1.7	0.19	2.5	0.31	2.4	0.28	1.1	0.13	1.7	0.2	1.4	0.17
Corpus uteri	1.3	0.25	0.6	0.08	1.3	0.17	3.8	0.47	1.6	0.19	0.9	0.12	1	0	1.3	0.17	2.6	0.33	1.7	0.21
Ovary	2.4	0.22	3.4	0.4	3.8	0.47	3.3	0.47	4.7	0.54	2.7	0.33	3.4	0.44	2.5	0.29	4.2	0.49	3.7	0.44
Kidney	0.5	0.06	1.4	0.15	1.4	0.18	0.6	0.06	1.1	0.11	1.5	0.2	0.8	0.08	1.1	0.11	2.9	0.33	2.1	0.23
Bladder	0.8	0	1.4	0.14	0.9	0.09	1.6	0.11	2.4	0.23	1.2	0.14	0	0	0.5	0.05	1.5	0.17	1.4	0.15
Brain, nervous system	0.6	0.07	2.5	0.26	2.2	0.22	2.6	0.34	1.8	0.19	1.4	0.13	1	0	1	0.1	3.9	0.4	2.9	0.3
Thyroid	1.1	0.09	1.4	0.16	2.9	0.31	1	0.08	1.4	0.14	2.3	0.11	2.8	0.23	2.5	0.3	1.8	0.24	1.7	0.21
Hodgkin lymphoma	0	0	0.6	0.06	1.3	0.12	0.1	0	1.2	0.13	0.9	0.08	0.2	0.01	0.7	0.06	0.7	0.07	0.7	0.07
Non-Hodgkin lymphoma	1	0.15	2.4	0.27	4	0.45	1.8	0.22	6.6	0.74	3.9	0.41	5	0.63	3.8	0.43	3.4	0.37	3.1	0.35
Multiple myeloma	1.5	0.21	1	0.12	1.4	0.18	0.7	0.07	1.6	0.18	0.9	0.1	1	0.12	0.7	0.07	2.1	0.25	1.5	0.18
Leukemia	1.5	0.2	3.8	0.37	3.6	0.36	4.2	0.5	4.1	0.4	4.1	0.35	2.8	0.3	2.5	0.24	3.6	0.35	3.6	0.35
All cancers excluding nonmelanoma skin cancer	50.6	5.87	72.7	7.81	85.5	9.27	69.3	7.82	89.6	9.37	54	5.67	66.6	7.38	52.7	5.81	86.7	9.43	77.7	8.45

ASR, age-standardized rates; CR, cumulative risk.

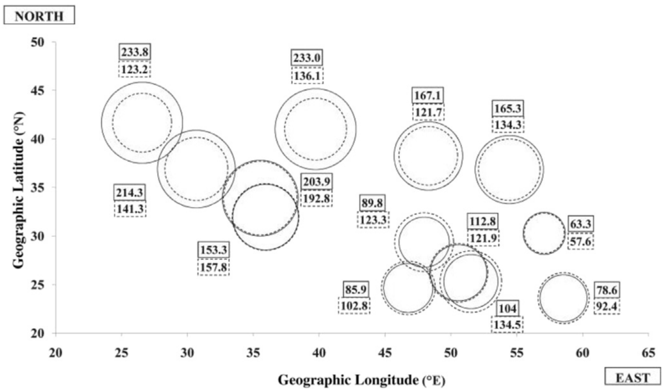

Figure 2. Incidence age-standardized rates (ASR; per 100,000 person-year) of cancers in West Asian countries. (Figure in each box indicates the ASR; size of bubbles represents the magnitude of ASRs; solid bubbles indicate men and dotted bobbles indicate women.)

RESULTS

Nine countries and 6 regional registries were included (Fig. 1). The ASRs and 5-year prevalence of cancers are presented for men and women of West Asian countries in Tables 1 and 2, respectively. The ASRs and cumulative risk for cancer mortality are shown in Tables 3 and 4 for men and women, respectively.

Cancers of lung (ASR, 33.3), prostate (24.9), bladder (19.1), stomach (16.5), and colorectal (15.9) were the most common malignancies in men. The most common cancers of women were those of the breast (35.4), colorectal (12.1), thyroid (10.3), stomach (9.2), and lung (6.7).

Figure 2 shows the ASR of cancers in West Asia. Spearman's correlation test suggested a significant positive correlation between the rate of male cancers and the geographic latitude (Spearman's $\rho = 0.87$; $P < .001$). The correlation was not significant for female cancers (Spearman's $\rho = 0.39$; $P = .19$).

The incidence of gastric cancer also was significantly correlated with the geographic latitude in both men (Spearman's $\rho = 0.82$; $P = .001$) and women (Spearman's $\rho = 0.79$; $P = .001$; Fig. 3).

Figure 4 shows the distribution of esophageal cancer in West Asian countries. As shown in Figure 5, we found significant positive correlation between the ASR of lung cancer in men and the geographic latitude of countries (Spearman's $\rho = 0.75$; $P = .003$). The distribution of breast and colorectal cancers (CRCs) are shown in Figures 6 and 7, respectively. High incidence rates of bladder (Fig. 8) and prostate (Fig. 9) cancers were found in Lebanon and Turkey.

DISCUSSION

Using data from Globocan-2012, we found the most common cancers in West Asia to be malignancies of lung, prostate, bladder, stomach, and colorectal in men and breast, colorectal, stomach, thyroid, and lung in women. A noteworthy observation is the striking differences in cancer mortality and incidence by geographic location.

All Cancers

The incidence of male cancers was considerably higher in the northern part of this region, consisting of Turkey, Lebanon, Jordan, and northern Iran compared with the southern countries comprising Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and southern Iran. This may suggest

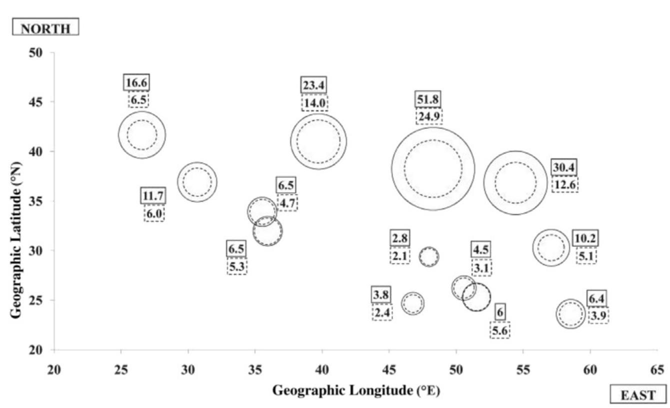

Figure 3. Incidence age-standardized rates (ASR; per 100,000 person-year) of gastric cancer in West Asian countries. (Figure in each box indicates the ASR; size of bubbles represents the magnitude of ASRs; solid bubbles indicate men and dotted bobbles indicate women.)

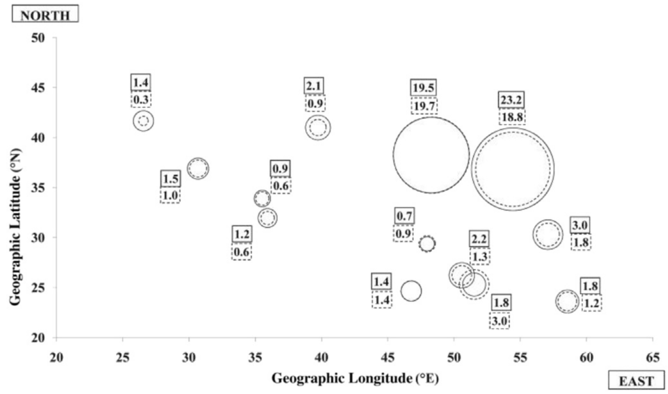

Figure 4. Incidence age-standardized rates (ASR; per 100,000 person-year) of esophageal cancer in West Asian countries. (Figure in each box indicates the ASR; size of bubbles represents the magnitude of ASRs; solid bubbles indicate men and dotted bobbles indicate women.)

higher prevalence of cancer risk factors including smoking,[5,6] and obesity.[7-9] The most common cancers differed by country. Lung cancer was the leading malignancy in men in Bahrain, Qatar, and Turkey, whereas CRC was the most common malignancy in Saudi and Jordanian men. Cancer of the stomach ranked highest among Iranian men. Prostate cancer was the most common in Kuwait, Lebanon, and Oman. Considering these differences, cancer control programs must be tailored to the most common types of cancers in each country.

Gastric Cancer

Gastric cancer does not occur equitably over West Asia, afflicting northern countries of Iran and Turkey to a greater extent compared with others. It is the second and the sixth most incidence malignancy in Iran and Turkey, respectively, whereas its incidence rank is relatively lower in other countries of this region, ranging from seventh in Qatar to 14th in Kuwait. Even within Iran, a striking difference is observed by geography where northern provinces experience a 6-fold incidence rate in comparison to the southern regions.[10]

Helicobacter pylori is the established class I risk factor for development of gastric cancer.[11] The infection is contracted at very young age and involves increasing fractions of a population with advancing age. The prevalence of *H pylori* reported from West Asian countries varies by the study population and diagnostic method used; nevertheless, according to data from the "WHO STEPwise approach to Surveillance of risk factors (STEPS) projects, all these countries indicate high rates of *H pylori* infection, resembling most other developing countries[12-16] (Table 5). Therefore, despite its status as *sine qua non*, factors other than *H pylori* seem to affect the disparity in gastric cancer incidence across regions.[17]

Numerous studies have attempted to identify the natural course of gastric cancer and the associated factors. Tobacco use,[18,19] excessive salt intake,[20,21] deficient consumption of fruit and vegetables,[22,23] and familial factors[24] are among those incriminated in this process. The variety of ethnicities and subcultures inhabiting this region of the world display an array of dietary and tobacco-related habits, which may account for the discrepancy in incidence of gastric cancer. Opium (an illicit drug used frequently in certain regions of West Asia) has been shown to be correlated with the occurrence of gastric cancer,[25] especially in light of a recent study that demonstrated that opium and hookah (a tobacco product popular in West Asian countries) are associated with not only an increased incidence of gastric cancer, but also its precancerous lesions.[26]

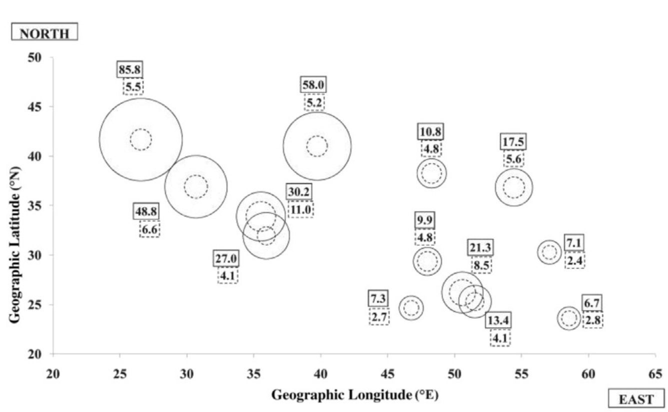

Figure 5. Incidence age-standardized rates (ASR; per 100,000 person-year) of lung cancer in West Asian countries. (Figure in each box indicates the ASR; size of bubbles represents the magnitude of ASRs; solid bubbles indicate men and dotted bobbles indicate women.)

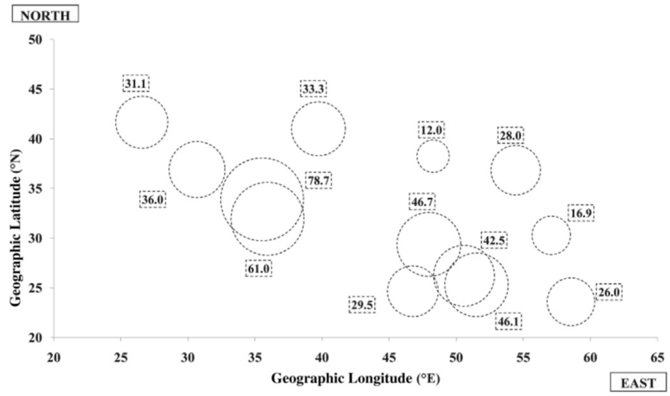

Figure 6. Incidence age-standardized rates (ASR; per 100,000 person-year) of breast cancer in West Asian countries, women. (Figure in each box indicates the ASR; size of bubbles represents the magnitude of ASRs).

Esophageal Cancer

The incidence rate of esophageal cancer was considerably high in the northeastern part of West Asia. This area (northern Iran) is located on the western edge of the Asian belt of upper gastrointestinal (GI) cancers, extending to north-central China in the East. An extremely high rate of esophageal cancer in this area was first reported in 1972.[3,4] Although recent reports suggest a decreasing trend for this cancer, it remains the top-ranking malignancy in this region.[27,28] According to the results of a large cohort study,[29] the most important risk factors for esophageal cancer in this area include drinking hot tea,[30] low socioeconomic status,[31] genetic susceptibility,[32,33] dietary habits,[34] opium and tobacco consumption,[35] and poor oral health.[36] Additionally, ecological studies from this region[37-39] suggested correlations between environmental factors and esophageal cancer. Esophageal cancer is a multifactorial condition and may not be successfully controlled by primary prevention (i.e., avoiding all possible risk factors). Therefore, it is recommended that screening programs be conducted in this area as well as in other high-risk regions.[40,41]

Figures 3 and 4 suggest a south to north gradient of upper GI (esophageal and gastric) cancers in West Asia. In other words, the incidence of upper GI cancers increases as we move northward in this region. This may be explained by the fact that in the north, the weather is cold and using biomass as the primary fuel for cooking and heating in poorly ventilated houses, may produce considerable amounts of polycyclic aromatic hydrocarbons (PAH)—a known risk factor for upper GI cancers.[42-44] It may be beneficial to take this point into consideration when planning for cancer prevention in this part of the world, as well as in other high-risk areas. Another declining trend is found in the incidence of upper GI cancer, starting in the northern areas of Iran and moving westward to reach the European borders of Turkey (Figs. 3 and 4).

Lung Cancer

We found a very high incidence rate of lung cancer in men in Turkey, Lebanon, and Jordan, located in the northwestern part of the study area. This may be partly explained by the high prevalence of smoking in these countries[5,6] (Table 5). Despite many local and national tobacco-control efforts during the recent decade, the prevalence of smoking remains high in Turkey.[45] Implementation of comprehensive tobacco-control programs may decrease the prevalence of this risk factor and

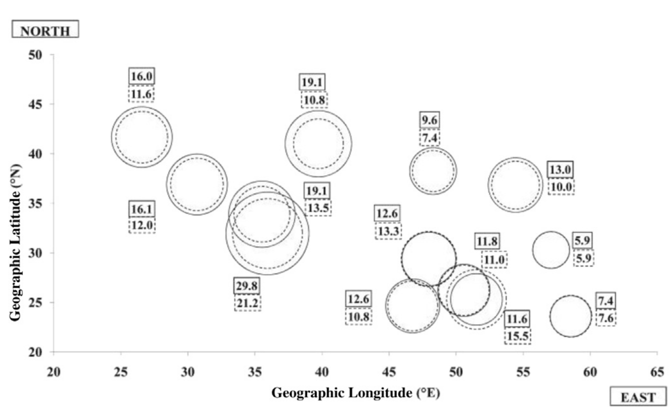

Figure 7. Incidence age-standardized rates (ASR; per 100,000 person-year) of colorectal cancer in West Asian countries. (Figure in each box indicates the ASR; size of bubbles represents the magnitude of ASRs; solid bubbles indicate men and dotted bobbles indicate women.)

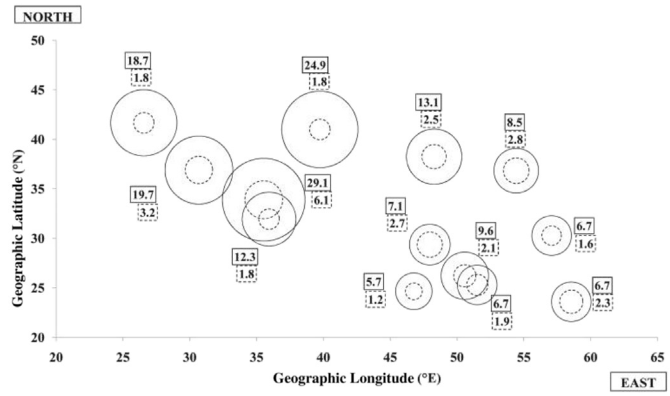

Figure 8. Incidence age-standardized rates (ASR; per 100,000 person-year) of bladder cancer in West Asian countries. (Figure in each box indicates the ASR; size of bubbles represents the magnitude of ASRs; solid bubbles indicate men and dotted bobbles indicate women.)

consequently help to decrease the burden of lung cancer in such high-risk areas.

Contrary to the upper GI cancer, the gradient of lung cancer rises from east to west (Fig. 5). In other words, as we move from Golestan, Iran in the East to Edirne, Turkey in the West, the incidence of upper GI cancer decreases, while the incidence of lung cancer increases. This interesting trend may warrant further international studies on these types of cancer in this region.

Breast Cancer

The incidence of breast cancer was high in some Arabian countries including Qatar, Kuwait, and Bahrain with the highest rates in Jordan and Lebanon. High prevalence of obesity, a risk factor for breast cancer, was reported in these countries[7,9,46] (Table 5). Reports from other countries such as Iran[47-49] also have shown that special consideration should be given to breast cancer in this region. Probable changes in the prevalence of risk factors of breast cancer including age at menarche, age at first pregnancy, number of pregnancies, duration of breast-feeding, and lifestyle and environmental exposures may influence the epidemiology of this common malignancy and increase its incidence and mortality rates and consequently its burden in this region in near future. Further studies are warranted to determine the risk factors for breast cancer, especially modifiable or preventable ones in West Asian countries.

Colorectal Cancer

High incidence of CRC was found in Jordan, Lebanon, and Turkey, located in the northwestern part of this region. Although recent reports suggest an increasing trend in the incidence rate of CRC in Iran,[27,28] it is still considered a low-risk area.[50,51] High prevalence of obesity[7,9] and lifestyle modifications including changes in physical activity and dietary habits[52-54] may partly explain the high incidence of CRC in parts of this region (Table 5). High CRC incidence rates were reported in young populations from parts of this region.[50,55] This may be explained by changes in diet and lifestyle favoring a Westernized pattern in the younger generation of these areas. Any effort in promoting healthier lifestyle in these populations may help to decrease the burden of this disease in such high-risk areas.

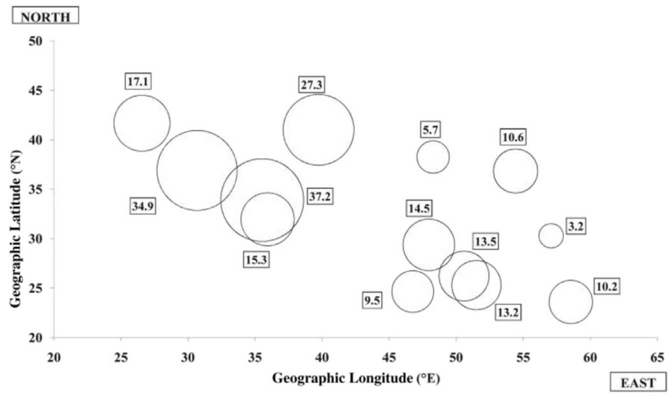

Figure 9. Incidence age-standardized rates (ASR; per 100,000 person-year) of prostate cancer in West Asian countries, men (Figure in each box indicates the ASR; size of bubbles represents the magnitude of ASRs).

Table 5. Prevalence (%) of Risk Factors for Cancers in West Asian Countries According to Most Recent Data of the STEPS* Survey on Chronic Disease Risk Factors for Each Country

Risk Factor	Bahrain	Iran	Jordan	Kuwait	Qatar	Saudi Arabia	Turkey
Smoking							
Total	19.9	14.76	29.0	20.6	14.7	-	35.6
Cigarettes	13.8	12.27	28.3	17.7	11.8	17.6	32.4
Hookah	8.4	2.53	-	2.0	-	2.9	-
Overweight/obesity	69.2%	46.0	67.4	75.4	70.1	66.2† 71.4‡	54.3
Physical inactivity	28.4%	35.22	5.2	64.7	45.9	67.7	34.3
Low fruit/vegetable intake	-	87.2	14.2	81.0	91.1	97.9† 99.2‡	81.4

*The WHO STEPwise approach to Surveillance of risk factors (STEPS).
†Men.
‡Women.

Bladder and Prostate Cancer

The incidence rates of bladder (in men) and prostate cancers were higher in the northwestern part of West Asia (Turkey and Lebanon). Smoking is proposed as the most important risk factor for bladder cancer in these countries.[56,57] Occupational exposure (e.g., to diesel) also has been suggested as a risk factor for this cancer.[56] Obesity and dietary habits have been proposed to play a role in the pathogenesis of prostate cancer[58,59] (Table 5). Therefore, controlling these risk factors must be considered in preventive programs in these areas.

Altitude and Cancer

Our results showed higher rates of cancers especially gastric and lung malignancies in countries and regions located in higher latitudes. Higher rates of mortality from cancers of the stomach, pharynx, and larynx in residents of high-altitude areas have been reported.[60] The results from a study in Latin America showed a positive association between gastric cancer risk and altitude.[61] The study's findings suggested altitude as a probable surrogate for genetic, dietary, and environmental risk factors for gastric cancer.

The geographical characteristics of West Asia suggest a positive correlation between latitude and altitude. In other words, countries and areas in higher latitude of this region also may have higher altitude. So, our finding on the correlation between cancer rates and latitude might be confounded by altitude. Further individual-based studies are warranted to clarify this point.

A major limitation of the present study is lack of high-quality data from some West Asian countries. The Globocan-2012 estimation of cancer incidence in these countries was made using cancer data from neighboring countries. This is mainly due to the absence of well-designed cancer registries in these countries.

CONCLUSION

We found considerable differences in the incidence and mortality of the most common cancers among West Asian countries. Cancer control programs must be tailored to the most common types of cancers in each country. As the first step of cancer control programs, it is recommended to establish well-structured population-based cancer registries in all these countries.

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