World Cancer Research Journal WCRJ 2017; 4 (4): e974

INCIDENCE AND MORTALITY OF GALLBLADDER CANCER AND ITS RELATIONSHIP WITH HUMAN DEVELOPMENT INDEX (HDI) IN ASIA IN 2012

N. MAHDAVIFAR[1], A. MOHAMMADIAN-HAFSHEJANI[2], M.GHAFARI[3], H. SALEHINIYA[4,5]

[1]Department of Epidemiology and Biostatistics, Health Promotion Research Center, School of Public Health, Zahedan University of Medical Sciences, Zahedan, Iran
[2]Department of Public Health, School of Public Health, Dezful University of Medical Sciences, Dezful, Iran
[3]Department of Public Health, School of Public Health, Shahrekord University of Medical Sciences, Shahrekord, Iran
[4]Zabol University of Medical Sciences, Zabol, Iran
[5]Department of Epidemiology and Biostatistics, School of Public Health, Teheran University of Medical Sciences, Teheran, Iran

Abstract – *Objective:* *Gallbladder cancer is a deadly malignancy, the sixth gastrointestinal cancer and one of the most common cancers of the biliary tract. This study aimed at investigating the incidence and mortality rate of gallbladder cancer and its relationship with Human Development Index (HDI) in Asia in 2012.*

Methods: *This study was an ecologic study in Asia for the assessment of the correlation between Standard Incidence Rate (SIR) and Standard Mortality Rate (SMR) with HDI and its components, which include: life expectancy at birth, mean years of schooling and Gross National Income (GNI) per capita. Statistical analyses were performed using SPSS (Version 15.0, SPSS Inc., Chicago, IL, USA).*

Results: *Overall, 116,048 cases of gallbladder cancer have been recorded in Asian countries in 2012. Countries with the highest SIR per 100,000 were Republic of Korea (6.5), Lao PDR (4.8), Japan (4.7), Nepal (4.3), Bangladesh (4.2) and the highest SMR were observed in Republic of Korea (4.8), Lao PDR (4.7), Nepal (4.1), Bangladesh (4), and Japan (3.9). There was a positive correlation between the SIR of Gallbladder cancer and HDI (r = 0.032, p =0.832), whereas there was a negative correlation between the SMR of Gallbladder cancer and HDI (r = -0.117,* p *=0.438).*

Conclusions: *Countries that have the highest SIR and SMR of gallbladder cancer do not have HDI levels associated with them since they span the ranks of countries with very high, medium, and low HDIs. A significant relationship was not observed between the SIR and SMR of gallbladder cancer and the HDI.*

KEYWORDS: *Gallbladder cancer, HDI, Asia, Incidence, Mortality.*

INTRODUCTION

Cancers are one of the non-communicable diseases that present the community with a major disease burden[1]. More than 70% of deaths that occur in both developing and developed countries have been linked to cancer[2]. One of these cancers is gallbladder cancer, which is a fatal malignancy[3]. Gallbladder cancer is not only the sixth most prevalent gastrointestinal cancer but also one of the most common cancers of the biliary tract. Its annual rate is 2.2 per 100,000 people around the world among rare and high-risk gastrointestinal cancers[1,4]. In addition, the incidence of gallbladder cancer is high in many parts of the world including Chile, Peru, Bolivia, Korea, Japan, the Czech Republic, Slovakia, Spain, and India[5]. Despite

Corresponding Author: Hamid Salehiniy, PhD candidate; e-mail: alesaleh70@yahoo.com

this, the incidence of this cancer is variable in different geographical areas. For example, in Chile this disease is the leading cause of cancer deaths in women[6]. In general, gallbladder cancer is more common in women while bile duct cancer is seen more frequently in men[7].

Based on previous studies, we can consider a number of potential risk factors that have been associated with gallbladder cancer including a history of gallstones or gallbladder disease[8], diet, tobacco use, exposure to wood or coal dust, long interval between meals, obesity, use of oral contraceptives, number of births, a family history of gallbladder disease[9], and genetic factors[10]. According to published studies, gallstones are present in 70% to 94% of patients with gallbladder cancer[5,11]. Due to both the anatomical location of the gallbladder and nonspecific symptoms of gallbladder cancer, the diagnosis of gallbladder cancer is usually made in the late stage of the disease accompanied by a poor prognosis. The negative impact of delayed diagnosis is supported by the findings of several studies that report the five-year survival rate to range from 5% to 12%[12-15].

One of the criteria used to evaluate both diseases and deaths between countries is the HDI. In fact, this indicator is associated with both the incidence and mortality of many diseases and is an appropriate source of information to learn a country's status regarding a specific disease[16]. Although communicable diseases and nutrition are common causes of death in countries with a low HDI, it is forecasted that before 2030, deaths from non-communicable diseases such as cancer, will overtake those from communicable diseases, thereby attaining more crucial positions[17]. The relationship between the HDI and some types of cancer has been studied[18-26]; investigating this relationship can lead to a more accurate understanding of the distribution of cancer and its risk factors[27]. Knowledge about the incidence and mortality of gallbladder cancer can be useful for the design and implementation of health programs and research activities because of the probable role of the HDI. The aim of this study was to investigate the incidence and mortality rate of gallbladder cancer and its relationship with the Human Development Index (HDI) and components in Asia in 2012.

METHODS

This study was an ecologic study in Asia to assess the correlation between the standard incidence rate (SIR) and the standard mortality rate (SMR) with Human Development Index (HDI) and its components, including life expectancy at birth, mean years of schooling, and the Gross National Income (GNI) per capita. Data about the SIR and the SMR for every country in 2012 were obtained from the Global Cancer Project available at (http://globocan.iarc.fr/Default.aspx)[28] and the HDI from the Human Development Report 2013[29] that includes information about the HDI and its components for every country in the word in 2012. The Human Development Index (HDI) is a composite measure of key indicators along three dimensions, including life expectancy, educational attainment, and command over resources needed for a decent standard of living[29].

Methods for estimating the incidence and mortality rates in the Global Cancer Project by the International Agency for Research on Cancer were published previously[1,28].

Statistical Analysis

In this study, we used a bivariate correlation method to assess the correlation between the SIR and the SMR with the HDI. Statistical significance was assumed if $p < 0.05$. All reported p-values are two-sided. Statistical analyses were performed using SPSS (version 15.0, SPSS Inc., Chicago, IL, USA).

RESULTS

Overall, 116,048 cases of gallbladder cancer were recorded in Asian countries in 2012. Of these cases, about 52,668 (45.38%) cases were in men, and 63,380 cases (54.61%) were in women. The sex ratio of developing the disease is 0.83 (men to women). The five countries with the highest number of new cases of gallbladder cancer are 1- China with 51,463 cases, 2- Japan with 21,417 cases, 3- India with 18,787 cases, 4- the Republic of Korea with 5,228 cases, and 5- Bangladesh with 4,712 cases. Therefore, these five countries represent 101,607 cases or 87.55% of all gallbladder cancer cases in Asia.

The five countries that have the highest SIR of gallbladder cancer per hundred thousand people in Asian countries are 1- the Republic of Korea with 6.5, 2- Lao PDR with 4.8, 3- Japan with 4.7, 4- Nepal with 4.3, and 5-Bangladesh with 4.2. In contrast, five countries that have the lowest SIR of gallbladder cancer per hundred thousand people are Maldives with zero and Yemen, Tajikistan, Turkmenistan, and Uzbekistan with 0.1 (Table 1).

TABLE 1. Number and rate of crude and SIR of gallbladder cancer in Asian countries in 2012 (based on GLOBOCAN 2012).

	Gallbladder - Estimated incidence all ages								
	Both sexes			*Male*			*Female*		
Population	*Numbers*	*Crude rate*	*ASR (W)*	*Numbers*	*Crude rate*	*ASR (W)*	*Numbers*	*Crude rate*	*ASR (W)*
Afghanistan	120	0.4	0.8	35	0.2	0.5	85	0.5	1.2
Armenia	29	0.9	0.6	13	0.9	0.7	16	1.0	0.5
Azerbaijan	46	0.5	0.5	23	0.5	0.5	23	0.5	0.4
Bahrain	6	0.4	0.8	3	0.4	0.8	3	0.6	0.9
Bangladesh	4712	3.1	4.2	1217	1.6	2.2	3495	4.6	6.2
Bhutan	11	1.5	2.1	5	1.3	1.9	6	1.7	2.3
Brunei	3	0.7	1.1	2	1.0	1.1	1	0.5	1.1
Cambodia	229	1.6	2.3	104	1.5	2.6	125	1.7	2.2
China	51463	3.8	2.8	23764	3.4	2.7	27699	4.2	2.9
Georgia	35	0.8	0.5	19	0.9	0.6	16	0.7	0.4
India	18787	1.5	1.8	7615	1.2	1.5	11172	1.8	2.1
Indonesia	1644	0.7	0.8	823	0.7	0.9	821	0.7	0.7
Iran, Islamic Republic of	753	1.0	1.2	328	0.9	1.0	425	1.1	1.4
Iraq	156	0.5	0.9	65	0.4	0.9	91	0.5	0.9
Israel	177	2.3	1.5	92	2.4	1.8	85	2.2	1.2
Japan	21417	16.9	4.7	10818	17.6	5.8	10599	16.3	3.7
Jordan	93	1.4	2.4	36	1.1	1.8	57	1.8	3.1
Kazakhstan	41	0.3	0.2	19	0.2	0.3	22	0.3	0.2
Korea, Democratic Republic of	764	3.1	2.4	325	2.7	2.7	439	3.5	2.3
Korea, Republic of	5228	10.8	6.5	2718	11.2	7.8	2510	10.3	5.4
Kuwait	17	0.6	1.1	9	0.5	1.1	8	0.7	1.3
Kyrgyzstan	40	0.7	1.1	13	0.5	0.9	27	1.0	1.2
Lao PDR	193	3.0	4.8	120	3.8	6.5	73	2.3	3.4
Lebanon	74	1.7	1.6	28	1.3	1.3	46	2.1	1.8
Malaysia	248	0.8	1.0	112	0.8	0.9	136	0.9	1.1
Maldives	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Mongolia	9	0.3	0.5	5	0.4	0.5	4	0.3	0.4
Myanmar	1210	2.5	2.7	358	1.5	1.7	852	3.4	3.6
Nepal	904	2.9	4.3	331	2.2	3.6	573	3.7	4.9
Oman	12	0.4	0.7	7	0.4	0.6	5	0.4	0.8
Pakistan	1839	1.0	1.5	543	0.6	0.9	1296	1.5	2.2
Philippines	342	0.4	0.5	154	0.3	0.5	188	0.4	0.5
Qatar	11	0.6	2.1	7	0.5	1.9	4	0.9	2.7
Saudi Arabia	309	1.1	1.9	104	0.7	1.2	205	1.6	2.8
Singapore	138	2.6	1.7	67	2.5	1.8	71	2.7	1.7
Sri Lanka	163	0.8	0.6	86	0.8	0.7	77	0.7	0.5
State of Palestine	59	1.4	2.8	16	0.7	1.6	43	2.0	4.0
Syrian Arab Republic	237	1.1	1.7	92	0.9	1.4	145	1.4	2.0
Tajikistan	5	0.1	0.1	2	0.1	0.1	3	0.1	0.1
Thailand	2794	4.0	3.0	1590	4.6	3.7	1204	3.4	2.3
Timor-Leste	14	1.2	2.5	10	1.7	3.8	4	0.7	1.3
Turkey	1260	1.7	1.8	747	2.0	2.3	513	1.4	1.3
Turkmenistan	4	0.1	0.1	2	0.1	0.1	2	0.1	0.1
United Arab Emirates	28	0.3	1.4	19	0.3	1.5	9	0.4	1.2
Uzbekistan	28	0.1	0.1	11	0.1	0.1	17	0.1	0.1
Viet Nam	386	0.4	0.5	211	0.5	0.5	175	0.4	0.4
Yemen	10	0.0	0.1	0	0.0	0.0	10	0.1	0.2

On the other hand, 98,643 deaths have occurred due to gallbladder cancer in Asia during 2012. Of these deaths, 44,198 cases (44.80%) were in men, and 54,445 cases (55.19%) were in women. The sex ratio of gallbladder cancer mortality is 0.81. Of these, most deaths have occurred in China with 41,973 cases, Japan with 19,309 cases, India with 15,866 cases, Bangladesh with 4,412 cases, and the Republic of Korea with 4,176 cases. Therefore, a total of 85,736 cases (86.91%) of deaths have occurred in just these five countries.

The five countries that have the highest SMR of gallbladder cancer per hundred thousand people in Asian countries are 1- the Republic of Korea with 4.8, 2- Lao PDR with 4.7, 3- Nepal with 4.1, 4- Bangladesh with 4, and 5- Japan with 3.9. In contrast, the five countries that have the lowest SMR of gallbladder cancer per hundred thousand people are Brunei and Maldives with the amount of zero, and Yemen, Tajikistan, and Turkmenistan with 0.1 (Table 2).

TABLE 2. Number and rate of crude and SMR of gallbladder cancer in Asian countries in 2012 (based on GLOBOCAN 2012).

	Gallbladder - Estimated mortality all ages								
	Both sexes			*Male*			*Female*		
Population	*Numbers*	*Crude rate*	*ASR (W)*	*Numbers*	*Crude rate*	*ASR (W)*	*Numbers*	*Crude rate*	*ASR (W)*
Afghanistan	113	0.3	0.8	32	0.2	0.5	81	0.5	1.1
Armenia	28	0.9	0.6	13	0.9	0.7	15	0.9	0.5
Azerbaijan	42	0.4	0.4	21	0.4	0.5	21	0.4	0.4
Bahrain	1	0.1	0.2	0	0.0	0.0	1	0.2	0.5
Bangladesh	4412	2.9	4.0	1153	1.5	2.1	3259	4.3	5.9
Bhutan	11	1.5	2.1	5	1.3	1.9	6	1.7	2.3
Brunei	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Cambodia	215	1.5	2.2	99	1.4	2.6	116	1.6	2.0
China	41973	3.1	2.3	19498	2.8	2.2	22475	3.4	2.3
Georgia	33	0.8	0.4	18	0.9	0.6	15	0.7	0.3
India	15866	1.3	1.5	6416	1.0	1.3	9450	1.6	1.8
Indonesia	1538	0.6	0.7	769	0.6	0.8	769	0.6	0.7
Iran, Islamic Republic of	707	0.9	1.1	306	0.8	0.9	401	1.1	1.3
Iraq	145	0.4	0.9	61	0.4	0.9	84	0.5	0.9
Israel	73	0.9	0.6	24	0.6	0.5	49	1.3	0.7
Japan	19309	15.3	3.9	9282	15.1	4.7	10027	15.5	3.3
Jordan	86	1.3	2.2	33	1.0	1.7	53	1.7	2.8
Kazakhstan	40	0.2	0.2	18	0.2	0.3	22	0.3	0.2
Korea, Democratic Republic of	641	2.6	2.0	283	2.3	2.4	358	2.9	1.8
Korea, Republic of	4176	8.6	4.8	2059	8.5	5.8	2117	8.7	4.0
Kuwait	11	0.4	0.8	5	0.3	0.4	6	0.5	1.4
Kyrgyzstan	38	0.7	1.0	12	0.4	0.8	26	0.9	1.1
Lao PDR	185	2.9	4.7	114	3.6	6.3	71	2.2	3.3
Lebanon	70	1.6	1.5	27	1.3	1.3	43	2.0	1.6
Malaysia	150	0.5	0.6	72	0.5	0.6	78	0.5	0.6
Maldives	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Mongolia	7	0.2	0.3	4	0.3	0.4	3	0.2	0.3
Myanmar	1140	2.3	2.6	338	1.4	1.7	802	3.2	3.4
Nepal	847	2.7	4.1	311	2.0	3.4	536	3.4	4.7
Oman	12	0.4	0.7	7	0.4	0.6	5	0.4	0.8
Pakistan	1721	1.0	1.4	506	0.6	0.9	1215	1.4	2.1
Philippines	256	0.3	0.4	117	0.2	0.4	139	0.3	0.4
Qatar	10	0.5	2.0	6	0.4	1.8	4	0.9	2.7
Saudi Arabia	288	1.0	1.8	96	0.6	1.1	192	1.5	2.7
Singapore	75	1.4	0.9	28	1.1	0.7	47	1.8	1.1
Sri Lanka	153	0.7	0.6	80	0.8	0.6	73	0.7	0.5
State of Palestine	55	1.3	2.7	16	0.7	1.7	39	1.9	3.8
Syrian Arab Republic	219	1.0	1.6	85	0.8	1.3	134	1.3	1.9
Tajikistan	5	0.1	0.1	2	0.1	0.1	3	0.1	0.1
Thailand	2381	3.4	2.5	1356	3.9	3.2	1025	2.9	2.0
Timor-Leste	13	1.1	2.3	9	1.5	3.4	4	0.7	1.3
Turkey	1175	1.6	1.7	693	1.9	2.2	482	1.3	1.3
Turkmenistan	4	0.1	0.1	2	0.1	0.1	2	0.1	0.1
United Arab Emirates	25	0.3	1.3	17	0.3	1.4	8	0.3	1.1
Uzbekistan	27	0.1	0.1	11	0.1	0.1	16	0.1	0.1
Viet Nam	358	0.4	0.4	194	0.4	0.5	164	0.4	0.4
Yemen	9	0.0	0.1	0	0.0	0.0	9	0.1	0.1

Relationship between the SIR and the HDI

A positive correlation of 0.032 was observed between the SIR of gallbladder cancer and the HDI, but this association was not statistically significant ($p = 0.832$). In contrast, a correlation was observed between dimensions of the HDI and the SIR, so that a positive correlation of 0.2 existed between the SIR and life expectancy at birth ($p = 0.183$), a negative correlation of 0.152 was present with mean years of education ($p = 0.312$), and income level per person of the population had a positive correlation of 0.103 ($p = 0.495$) (Figure 1).

Relationship between the SIR and the HDI in men

In addition, a positive correlation of 0.144 was seen between the SIR of gallbladder cancer and the HDI in men, but this association was not statistically significant ($p = 0.341$). A positive correlation was also observed between the dimensions of the HDI and the SIR. Similarly, a positive correlation of 0.241 was seen between the SIR and both life expectancy at birth ($p = 0.107$) and income level per person of the population 0.144 ($p = 0.339$). In contrast, a negative correlation of 0.040 was seen with mean years of education ($p = 0.790$).

Relationship between the SIR and the HDI in women

A negative correlation of 0.085 was seen between the SIR of gallbladder cancer and the HDI in women, but this association was not statistically significant ($p = 0.573$). Also, a correlation was observed between the dimensions of the HDI and the SIR, so that a positive correlation of 0.122 was seen between the SIR and life expectancy at birth ($p = 0.420$), a negative correlation of 0.252 was observed with mean years of education ($p = 0.091$), and a positive correlation of 0.074 was seen with income level per person of the population ($p = 0.626$).

Relationship between the SMR and the HDI

A negative correlation (0.117) was observed between the SMR of gallbladder cancer and the HDI, but this association was not statistically significant ($p = 0.438$). In addition, a correlation was observed between the dimensions of the HDI and standardized mortality rates. In fact, the correlation was positive between the SMR and both life expectancy at birth 0.078 ($p = 0.606$), and income level per person of the population. This positive correlation was 0.003 ($p = 0.983$), while there was a negative correlation with mean years of education 0.271 ($p = 0.568$) (Figure 2).

Relationship between the SMR and the HDI in men

A negative correlation of 0.018 was seen between the SMR of gallbladder cancer and the HDI in men, but this association was not statistically significant ($p = 0.908$). Also, a correlation was observed between the dimensions of the HDI and the SMR. A positive correlation of 0.110 was seen between the SMR and life expectancy at birth ($p = 0.469$), a negative correlation of 0.162 was observed with mean years of education ($p = 0.283$), and a positive correlation of 0.021 was seen with income level per person of the population ($p = 0.891$).

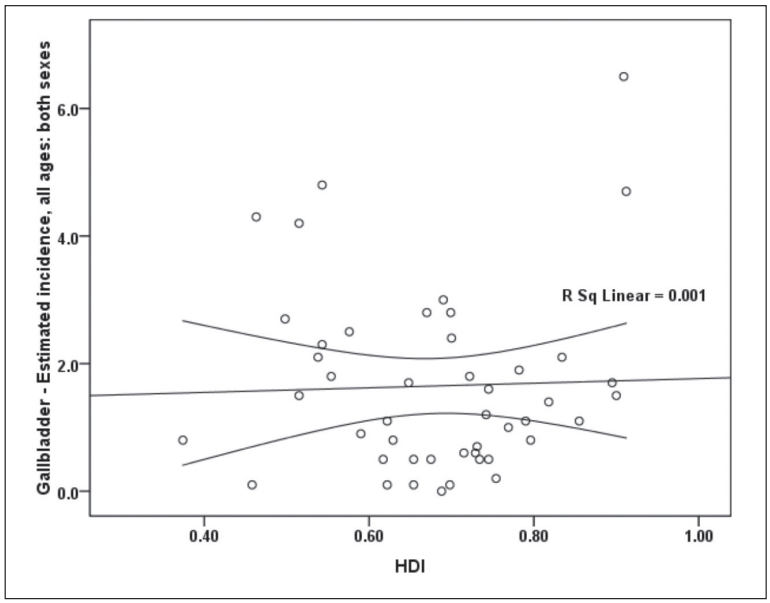

Fig. 1. The correlation between the SIR and HDI of gallbladder cancer in Asia in 2012.

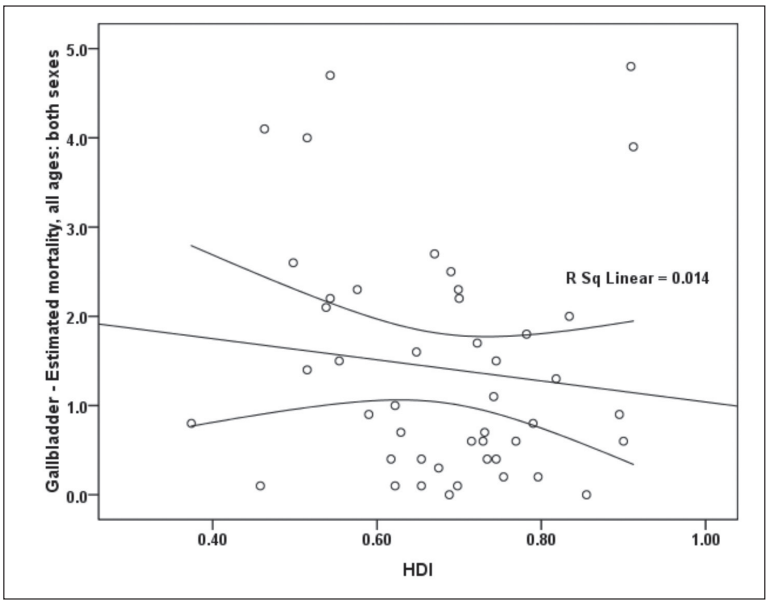

Fig. 2. The correlation between the SMR and HDI of gallbladder cancer in Asia in 2012.

Relationship between the SMR and the HDI in women

A negative correlation of 0.180 was seen between the SIR of gallbladder cancer and the HDI in women, but this association was not statistically significant (p = 0.232). In addition, a correlation was observed between the components of the HDI with the SMR, so that a positive correlation of 0.045 was seen between the SMR and life expectancy at birth (p = 0.765), a negative correlation of 0.334 was seen with mean years of education (p = 0.023), and a positive correlation of 0.022 was observed with income level per person of the population (p = 0.885).

DISCUSSION

Overall, 116,048 new cases and 98,643 deaths from gallbladder cancer were recorded in Asia in 2012. The sex ratio of developing the disease (male to female) was 0.83 and the sex ratio of deaths from gallbladder cancer was 0.81. Both the incidence and mortality of this cancer are different in diverse geographical areas and disparate ethnic groups[5,33], because of differences in risk factors related to disease progression and clinical symptoms at diagnosis in different areas[5,34].

In this study, countries that have the highest standardized rates of gallbladder cancer are in the ranks of countries with a very high HDI (Japan and the Republic of Korea), countries with an average HDI (Bangladesh and Lao PDR), and a low HDI (Nepal). In Japan, with a relatively high prevalence, gallbladder cancer is responsible for 3.5% of deaths in women and 1.25% in men[35]. Also, according to a recent report by the Council of Medical Research, India is one of the countries with the highest incidence of this cancer in the world. The incidence in Northern India is more than nine per 100,000 women per year[36]. The basis for the difference in incidence is because of differences in the distribution of risk factors such as geographical location, genetic predisposition[11,37], dietary habits, fertility, age, and gender (four to seven times more common in women than in men)[38].

In this study, countries that have the highest SMR of gallbladder cancer also include countries with a very high HDI (Japan and the Republic of Korea), with a high HDI (China), and with an average HDI (Bangladesh and India). India is known as one of the regions with the highest mortality rates in Asia[33]. The mortality of gallbladder cancer is related to the stage of the disease when the diagnosis is made. For example, if the disease is diagnosed from stage 0 to stage IV, then the five-year survival rate of this cancer can vary from 60% for stage 0 to 1% for stage IV of this cancer[3]. The highest mortality is associated with patients whose disease is diagnosed in stage III and higher[39]. From an epidemiologic perspective, the incidence rate of gallbladder cancer is close to the mortality rate so that countries with the highest incidence, experience the highest mortality rates. Lack of access to health care and early diagnosis in some areas both contribute to these increases[34]. In this study, no significant relationship was observed between the incidence and the mor-

tality of gallbladder cancer and the HDI. Also, a significant relationship was not seen between the standardized incidence rate and the standardized mortality rate of gallbladder cancer and dimensions of the HDI. However, according to previous studies, gallbladder cancer has been reported as a disease whose peak incidence in older women is during the 7th and 8th decades of life. Also, a study in India showed that this disease mainly occurs in women in the fourth decade of life, and after that because of the lower life expectancy of men[40]. The reason why gallbladder cancer occurs at younger ages in Indian women may indicate a genetic predisposition in this population[41].

In this study, no significant relationship has been observed between the SIR and the SMR of gallbladder cancer and HDI and its components (life expectancy at birth, mean years of schooling, and gross national income (GNI) per capita). Another study in Poland has introduced a low level of education as one of the main risk factors for these cancers[42]. In general, people with a low education are more affected by risk factors for this cancer[43]. In countries with citizens who have a higher level of education, people typically have healthier habits and more wholesome behaviors that enable them to avoid cancer risk factors such as smoking and eating unhealthy diets, when compared with countries whose citizens have a lower level of education[44,45].

Another result of this study is that a significant relationship was not observed between the standardized incidence and mortality rate and appropriate income levels (GDP). According to previous studies, the precise roles of socioeconomic status and gallstones have been discussed[6]. Studies have shown that gallstones and low socioeconomic status are independent risk factors for both early onset and mortality of gallbladder cancer[46]. Low socioeconomic status indirectly affects poor education, illiteracy, and may lead to joblessness. This resultant inability to pay for the costs of life and preventive healthcare services may adversely affect both the incidence and mortality of gallbladder cancer[47].

CONCLUSIONS

Countries that have the highest SIR and SMR of gallbladder cancer are in the ranks of countries with very high, medium and low HDI. A significant relationship was not observed between the SIR and SMR of gallbladder cancer, and the HDI.

Conflict of Interests:
The authors declared no competing interests.

REFERENCES

1. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer 2015; 136: 359-386.
2. Kamo KI, Kaneko S, Satoh K, Yanagihara H, Mizuno S, Sobue T. A mathematical estimation of true cancer incidence using data from population-based cancer registries. Jpn J Clin Oncol 2007; 37: 150-155.
3. Hueman MT, Vollmer Jr CM, Pawlik TM. Evolving treatment strategies for gallbladder cancer. Ann Surg Oncol 2009; 16: 2101-2115.
4. Noel R, Arnelo U, Lundell L, Sandblom G. Does the frequency of cholecystectomy affect the ensuing incidence of gallbladder cancer in Sweden? A population-based study with a 16-year coverage. World J Surg 2016; 40: 66-72.
5. Randi G, Franceschi S, La Vecchia C. Gallbladder cancer worldwide: geographical distribution and risk factors. Int J Cancer 2006; 118: 1591-1602.
6. Stinton LM, Shaffer EA. Epidemiology of gallbladder disease: cholelithiasis and cancer. Gut Liver 2012; 6: 172-187.
7. Power D, Brown R, Brock C, Payne H, Majeed A, Babb P. Trends in testicular carcinoma in England and Wales, 1971-99. BJU Int 2001; 87: 361-365.
8. Zuckerman AJ. Prevention of primary liver cancer by immunization. N Engl J Med 1997; 336: 1906-1907.
9. Jain K, Sreenivas V, Velpandian T, Kapil U, Garg PK. Risk factors for gallbladder cancer: a case-control study. Int J Cancer 2013; 132: 1660-1666.
10. Maurya SK, Tewari M, Mishra RR, Shukla HS. Genetic aberations in gallbladder cancer. Surg Oncol 2012; 21: 37-43.
11. Lazcano-Ponce EC, Miquel J, Muñoz N, Herrero R, Ferrecio C, Wistuba II. Epidemiology and molecular pathology of gallbladder cancer. CA Cancer J Clin 2001; 51: 349-364.
12. Cubertafond P, Mathonnet M, Gainant A, Launois B. Radical surgery for gallbladder cancer. Results of the French surgical association survey. Hepatogastroenterology 1998; 46: 1567-1571.
13. Kiran R, Pokala N, Dudrick S. Incidence pattern and survival for gallbladder cancer over three decades¬ – an analysis of 10301 patients. Ann Surg Oncol 2007; 14: 827-832.
14. Hundal R, Shaffer EA. Gallbladder cancer: epidemiology and outcome. Clin Epidemiol 2014; 6: 99-107.
15. Konstantinidis IT, Deshpande V, Genevay M, Berger D, Fernandez-del Castillo C, Tanabe KK. Trends in presentation and survival for gallbladder cancer during a period of more than 4 decades: a single-institution experience. Arch Surg 2009; 144: 441-447.
16. Arabsalmani M, Mirzaei M, Ghoncheh M, Soroush A, Towhidi F, Salehiniya H. Incidence and mortality of liver cancer and their relationship with the human development index in the world. Biomed Res Therapy 2016; 3: 800-807
17. Wagner KH, Brath H. A global view on the development of non communicable diseases. Prev Med 2012; 54: 38-41.
18. Rafiemanesh H, Mohammadian-Hafshejani A, Ghoncheh M, Sepehri Z, Shamlou R, Salehiniya H. Incidence and mortality of colorectal cancer and relationships with the human development index across the world. Asian Pac J Cancer Prev 2016;17: 2465-2473.
19. Mohammadian M, Soroush A, Mohammadian-Hafshejani A, Towhidi F, Hadadian F, Salehiniya H. The incidence and mortality of liver cancer and its relationship with development in Asia. Asian Pac J Cancer Prev 2016; 17: 2041-2047.

20. Shuja M, Islamie Farsani S, Salehiniya H, Khazaei S, Mohammadian M, Aryaie M. Assessment the association between liver cancer incidence and mortality rate with human development index in the European countries in 2012. Biomed Res Ther 2017; 4: 1185-1197.
21. Ghoncheh M, Mohammadian M, Mohammadian-Hafshejani A, Salehiniya H. The incidence and mortality of colorectal cancer and its relationship with the human development index in Asia. Ann Glob Health 2016; 82: 726-737.
22. Arabsalmani M, Mohammadian-Hafshejani A, Ghoncheh M, Hadadian F, Towhidi F, Vafaee K. Incidence and mortality of kidney cancers, and human development index in Asia; a matter of concern. J Nephropathol 2017; 6: 30-38.
23. Tiyuri A, Mohammadian-Hafshejani A, Iziy E, Gandomani HS, Salehiniya H. The incidence and mortality of lip and oral cavity cancer and its relationship to the 2012 Human Development Index of Asia. Biomed Res Therapy 2017; 4: 1147-1165.
24. Razi S, Ghoncheh M, Mohammadian-Hafshejani A, Aziznejhad H, Mohammadian M, Salehiniya H. The incidence and mortality of ovarian cancer and their relationship with the Human Development Index in Asia. Ecancermedicalscience 2016; 10: 628-635.
25. Hassanipour-Azgomi S, Mohammadian-Hafshejani A, Ghoncheh M, Towhidi F, Jamehshorani S, Salehiniya H. Incidence and mortality of prostate cancer and their relationship with the Human Development Index worldwide. Prostate Int 2016; 4: 118-124.
26. Mohammadian M, Ghafari M, Khosravi B, Salehiniya H, Aryaie M, Bakeshei FA. Variations in the incidence and mortality of ovarian cancer and their relationship with the Human Development Index in European countries in 2012. Biomed Res Therapy 2017; 4: 1541-1557.
27. Rimpelä AH, Pukkala EI. Cancers of affluence: positive social class gradient and rising incidence trend in some cancer forms. Soc Sci Med 1987; 24: 601-606.
28. Ferlay J SI, Ervik M, Dikshit R, Eser S, Mathers C. GLOBOCAN 2012 v1.0, cancer incidence and mortality worldwide: IARC CancerBase No. 11 [Internet]. Lyon, France: International Agency for Research on Cancer; 2013. Available from: http://globocan.iarc.fr, accessed on 2/8/2016
29. Human development report 2013. The rise of the south: Human progress in a diverse world. The Rise of the South: Human Progress in a Diverse World (March 15, 2013) UNDP-HDRO Human Development Reports 2013.
30. Ferlay J SI, Dikshit R, Eser S, Mathers C, Rebelo M, Parkin DM, Forman D, Bray F. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer 2015; 136: 359-386.
31. Ghoncheh M, Mirzaei M, Salehiniya H. Incidence and mortality of breast cancer and their relationship with the human development index (HDI) in the world in 2012. Asian Pac J Cancer Prev 2015; 16: 8439-8443.
32. Hassanipour-Azgomi S, Mohammadian-Hafshejani A, Ghoncheh M, Towhidi F, Jamehshorani S, Salehiniya H. Incidence and mortality of prostate cancer and their relationship with the Human Development Index worldwide. Prostate Int 2016; 4: 118-124.
33. Kazmi HR, Chandra A, Nigam J, Noushif M, Parmar D, Gupta V. Prognostic significance of K-ras codon 12 mutation in patients with resected gallbladder cancer. Dig Surg 2013; 30: 233-239.
34. Wistuba II, Gazdar AF. Gallbladder cancer: lessons from a rare tumour. Nat Rev Cancer 2004; 4: 695-706.
35. Kayahara M, Nagakawa T. Recent trends of gallbladder cancer in Japan. Cancer 2007; 110: 572-580.
36. Bray F, Jemal A, Grey N, Ferlay J, Forman D. Global cancer transitions according to the Human Development Index (2008-2030): a population-based study. Lancet Oncol 2012; 13: 790-801.
37. Hundal R, Shaffer EA. Gallbladder cancer: epidemiology and outcome. Clin Epidemiol 2014; 6: 99-105.
38. Gupta S, Kori C, Kumar V, Misra S, Akhtar N. Epidemiological study of gallbladder cancer patients from North Indian gangetic planes – a high-volume centre's experience. J Gastrointest Cancer 2016; 47: 27-35.
39. Baig M, Guarino M, Petrelli N. Report on demographics of gall bladder cancer in Delaware and retrospective review of treatment strategies for gallbladder cancer in a large community cancer center. Surg Oncol 2016; 25: 86-91.
40. Scott TE, Carroll M, Cogliano FD, Smith BF, Lamorte WW. A case-control assessment of risk factors for gallbladder carcinoma. Dig Dis Sci 1999; 44: 1619-1625.
41. Hsing AW, Bai Y, Andreotti G, Rashid A, Deng J, Chen J, Goldstein L, HanTQ, Shen MC, Fraumeni J, Gao YT. Family history of gallstones and the risk of biliary tract cancer and gallstones: a population-based study in Shanghai, China. Int J Cancer 2007; 121: 832-838.
42. Zatonski WA, La Vecchia C, Przewozniak K, Maisonneuve P, Lowenfels AB, Boyle P. Risk factors for gallbladder cancer: a Polish case-control study. Int J Cancer 1992; 51: 707-711.
43. Bertran E, Heise K, Andia ME, Ferreccio C. Gallbladder cancer: incidence and survival in a high risk area of Chile. Int J Cancer 2010; 127: 2446-2454.
44. Stelmach W, Kaczmarczyk-Chalas K, Bielecki W, Drygas W. The impact of income, education and health on lifestyle in a large urban population of Poland (Cindi programme). Int J Occup Med Environ Health 2004; 17: 393-401.
45. Shi L. Sociodemographic characteristics and individual health behaviors. South Med J 1998; 91: 933-941.
46. Dutta U, Nagi B, Garg P, Sinha S, Singh K, Tandon R. Patients with gallstones develop gallbladder cancer at an earlier age. Eur J Cancer Prev 2005; 14: 381-385.
47. Tyagi B, Manoharan N, Raina V. Risk factors for gallbladder cancer: a population based case-control study in Delhi. Indian J Med Paediatr Oncol 2008; 29: 16-26.