Original Article

The incidence and mortality of lung cancer and their relationship to development in Asia

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Background: Lung cancer is the deadliest cancer worldwide and the most common cancer in Asia. It is necessary to get information on epidemiology and inequalities related to incidence and mortality of the cancer to use for planning and further research. This study aimed to investigate epidemiology and inequality of incidence and mortality from lung cancer in Asia.

Methods: The study was conducted based on data from the world data of cancer and the World Bank [including the Human Development Index (HDI) and its components]. The incidence and mortality rates, and cancer distribution maps were drawn for Asian countries. To analyze data, correlation test between incidence and death rates, and HDI and its components at significant was used in the significant level of 0.05 using SPSS software.

Results: A total of 1,033,881 incidence (71.13% were males and 28.87% were females. Sex ratio was 2.46) and 936,051 death (71.45% in men and 28.55% in women. The sex ratio was 2.50) recorded in Asian countries in 2012. Five countries with the highest standardized incidence and mortality rates of lung cancer were Democratic Republic of Korea, China, Armenia, Turkey, and Timor-Leste, respectively. Correlation between HDI and standardized incidence rate was 0.345 (P=0.019), in men 0.301 (P=0.042) and in women 0.3 (P=0.043); also between HDI and standardized mortality rate 0.289 (P=0.052), in men 0.265 (P=0.075) and in women 0.200 (P=0.182).

Conclusions: The incidence of lung cancer has been increasing in Asia. It is high in men. Along with development, the incidence and mortality from lung cancer increases. It seems necessary to study reasons and factors of increasing the incidence and mortality of lung cancer in Asian countries.

Keywords: Epidemiology; incidence; mortality; lung cancer; inequality; Asia

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Introduction

Lung cancer is the major cause of cancer death in men in the world and the second leading cause of cancer death in women worldwide. It is the most common cancer in the whole of Asia (1,2). This cancer is the most deadly cancer in the world. It was reported only 1,033,881 cases of lung cancer in Asia, of whom 926,436 died from the cancer in 2012 (3). The incidence of lung cancer is different in various regions. The mean incidence varied from 0.06 to 31.5 per 100,000 (4). During the past two decades, death due to smoking was significantly lower in men, for extensive campaigning of smoking. It, however, has been a large increase in women (5). Lung cancer is associated with heavy burdens on communities. The highest burden of the disease was observed in countries in South East Asia (6).

Many factors influence the risk of developing lung cancer. Human Development Index (HDI) is one of these factors known as an independent predictor. Studies have shown that HDI is associated with the incidence and distribution of cancer types (7,8). Lung cancer is the most common cancer in all communities with different HDI. In communities with high HDI, the incidence of lung cancer is rising in women (9).

There is no comprehensive information on the incidence and mortality of lung cancer is in Asia. It is necessary to get information on epidemiology and inequalities related to incidence and mortality of the cancer to use for planning and further research. This study aimed to investigate epidemiology and inequality of incidence and mortality from lung cancer in Asia.

Methods

This study was an ecologic study in Asia for assessment the correlation between age-specific incidence and mortality rate (ASR) with HDI and its details that include: life expectancy at birth, mean years of schooling and gross national income (GNI) per capita. Data about the ASR for every Asian counter for year 2012 get from global cancer project that available in (http://globocan.iarc.fr/Default.aspx) and HDI from Human Development Report 2013 (10). That includes information about HDI and its details for every country in the word for year 2012.

Methods of estimate the ASRs in global cancer project by international agency for research on cancer

Age-specific incidence rate estimate

The methods of estimation are country specific and the quality of the estimation depends upon the quality and on the amount of the information available for each country. In theory, there are as many methods as countries, and because of the variety and the complexity of these methods, an overall quality score for the incidence and mortality estimates combined is almost impossible to establish. However an alphanumeric scoring system which independently describes the availability of incidence and mortality data has been established at the country level. The combined score is presented together with the estimates for each country with an aim of providing a broad indication of the robustness of the estimation. The methods to estimate the sex- and age-specific incidence rates of cancer for a specific country fall into one of the following broad categories, in priority order:

(I) Rates projected to 2012 (38 countries);
(II) Most recent rates applied to 2012 population (20 countries);
(III) Estimated from national mortality by modelling, using incidence mortality ratios derived from recorded data in country-specific cancer registries (13 countries);
(IV) Estimated from national mortality estimates by modelling, using incidence mortality ratios derived from recorded data in local cancer registries in neighboring countries (9 European countries);
(V) Estimated from national mortality estimates using modelled survival (32 countries);
(VI) Estimated as the weighted average of the local rates (16 countries);
(VII) One cancer registry covering part of a country is used as representative of the country profile (11 countries);
(VIII) Age/sex specific rates for "all cancers" were partitioned using data on relative frequency of different cancers (by age and sex) (12 countries);
(IX) The rates are those of neighboring countries or registries in the same area (33 countries) (3,11,12).

Age-specific mortality rate estimate

Depending of the degree of detail and accuracy of the national mortality data, six methods have been utilized in the following order of priority:

(I) Rates projected to 2012 (69 countries);
(II) Most recent rates applied to 2012 population (26 countries);
(III) Estimated as the weighted average of regional rates (1 country);

(IV) Estimated from national incidence estimates by modelling, using country-specific survival (2 countries);
(V) Estimated from national incidence estimates using modelled survival (83 countries);
(VI) The rates are those of neighboring countries or registries in the same area (3 countries) (3,11,12).

Human Development Index (HDI)

HDI, a composite measure of indicators along three dimensions: life expectancy, educational attainment and command over the resources needed for a decent living. All groups and regions have seen notable improvement in all HDI components, with faster progress in low and medium HDI countries. On this basis, the world is becoming less unequal. Nevertheless, national averages hide large variations in human experience. Wide disparities remain within countries of both the North and the South, and income inequality within and between many countries has been rising (10).

Statistical analysis

In this study, we use of correlation bivariate method for assessment the correlation between ASR with HDI and its details that include: life expectancy at birth, mean years of schooling and GNI per capita. 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.).

Results

A total of 1,033,881 lung cancer cases were recorded in Asian countries in 2012. Overall, 735,450 cases (71.13%) were males and 298,431 cases (28.87%) were females. Sex ratio in Asia was 2.46. The five countries with the highest number of the patients were China (652,842 cases), Japan (94,885 cases), India (70,275 cases), Indonesia (34,694 cases), and Turkey (24,489 cases), respectively. The five countries include a total of 877,157 cases (84.84%) of all cases in Asia. The five countries with the lowest number of the patients were Maldives (18 cases), Bhutan (38 cases), Brunei (61 cases), Oman (76 cases), and Qatar (79 cases), respectively.

Among Asian countries, five countries with the highest standardized incidence rates of lung cancer were Democratic Republic of Korea with 44.2 per 100,000, China with 36.1 per 100,000, Armenia with 35.9 per 100,000, Turkey with 34.7 per 100,000, and Timor-Leste with 31 per 100,000, respectively. Five countries with the lowest standardized incidence rates of the cancer were Yemen with 3.8 per 100,000, Saudi Arabia with 5.1 per 100,000, Oman with 5.1 per 100,000, Pakistan with 5.8 per 100,000, and Sri Lanka with 6.2 per 100,000, respectively. The number and crude and standardized incidence rates of the cancer in Asian countries based on sex are presented in *Table 1*. Countries in the table are sorted from high to low based on the standardized incidence rate. The countries with the highest and lowest standardized incidence rate are observable in *Table 1* and *Figure 1*.

However, in 2012, in Asia, the number of deaths due to lung cancer was 936,051 cases, 668,765 cases (71.45%) in men and 267,286 cases (28.55%) in women. The sex ratio (male to female) of mortality was equal to 2.50. The five countries with the highest number of deaths were China (597,182 cases), Japan (75,119 cases), India (63,759 cases), Indonesia (30,904 cases), and Turkey (21,915 cases), respectively. The countries included a total of 788,879 cases (85.15%) of the total mortality in Asia. Five countries that had the lowest number of deaths from lung cancer were Maldives (18 cases), Bhutan (36 cases), Brunei (54 cases), Bahrain (64 cases), and Oman (70 cases), respectively.

In Asian countries, five countries with the highest standardized mortality rates from lung cancer were Democratic Republic of Korea with 40.9 per 100,000, China with 32.5 per 100,000, Armenia with 32 per 100,000, Turkey with 31.1 per 100,000, and Timor-Leste with 27.9 per 100,000, respectively. Five countries had the lowest standardized mortality rates from the cancer were Yemen with 3.4 per 100,000, Saudi Arabia with 4.7 per 100,000, Oman with 4.8 per 100,000, Pakistan with 5.2 per 100,000, and Sri Lanka with 5.5 per 100,000, respectively. The number and crude and standardized incidence rates of the cancer in Asian countries based on sex are presented in *Table 2*. Countries in the table are sorted from high to low based on the standardized incidence rate. The countries with the highest and lowest standardized incidence rate are observable in *Table 2* and *Figure 1*.

In *Table 3*, amounts related to HDI and its components for each of the Asian countries (sorted based on HDI) is shown. Accordingly, Asian countries are classified according to HDI as follows: three countries in the very high category, four countries in high, 35 countries in the middle category, three countries in low, and one in the unknown category.

Table 1 Number, crude and standardized incidence rate of lung cancer in Asian countries in 2012 (sorted by age standardized rates from highest to lowest)

Lung-estimated incidence, all ages: both sexes				Lung-estimated incidence, all ages: male				Lung-estimated incidence, all ages: female			
Population	Numbers	Crude rate	ASR (W)	Population	Numbers	Crude rate	ASR (W)	Population	Numbers	Crude rate	ASR (W)
Democratic People's Republic of Korea	13,859	56.4	44.2	Armenia	1,301	89.9	72.9	Democratic People's Republic of Korea	6,501	52.0	33.4
China	652,842	48.0	36.1	Turkey	21,170	57.0	63.9	Brunei	27	13.2	22.0
Armenia	1,578	50.8	35.9	Kazakhstan	3,832	48.7	59.2	China	193,347	29.5	20.4
Turkey	24,489	32.9	34.7	Democratic People's Republic of Korea	7,358	61.1	58.5	Timor-Leste	58	10.0	19.1
Timor-Leste	182	15.3	31.0	China	459,495	65.0	52.8	Myanmar	3,694	14.9	16.2
Republic of Korea	22,873	47.1	28.7	Republic of Korea	15,724	64.9	45.5	Republic of Korea	7,149	29.3	16.2
Kazakhstan	4,684	28.6	27.9	Timor-Leste	124	20.5	43.8	Singapore	650	24.9	15.5
Viet Nam	21,865	24.4	25.2	Viet Nam	16,082	36.2	41.1	Israel	847	21.7	14.4
Singapore	1,974	37.6	24.9	Japan	66,016	107.3	38.8	Japan	28,839	44.4	12.9
Japan	94,855	75.0	24.6	Singapore	1,324	50.0	35.7	Thailand	6,411	18.0	12.6
Brunei	61	14.8	22.7	Philippines	8,822	18.2	31.3	Viet Nam	5,783	12.8	12.2
Israel	2,270	29.5	21.2	Georgia	931	45.9	30.8	Lebanon	272	12.4	11.0
Thailand	19,505	27.9	20.9	Thailand	13,094	38.1	30.7	Nepal	1,189	7.6	10.4
Myanmar	8,504	17.5	20.2	Lebanon	625	29.8	30.2	Armenia	277	16.7	10.3
Lebanon	897	20.9	19.8	Israel	1,423	37.4	29.5	Philippines	3,252	6.8	9.5
Philippines	12,074	12.5	19.3	Mongolia	228	16.2	27.7	Malaysia	1,163	8.0	9.2
Malaysia	4,403	15.0	17.9	Jordan	506	15.2	27.0	Turkey	3,319	8.9	8.8
Indonesia	34,696	14.2	16.3	Malaysia	3,240	21.8	26.9	Bahrain	20	3.9	8.5
Georgia	1,129	26.2	15.9	Kyrgyzstan	453	16.9	26.8	Indonesia	9,374	7.6	8.1
Jordan	583	9.0	15.7	Indonesia	25,322	20.8	25.8	Kazakhstan	852	10.0	8.1
Mongolia	292	10.3	15.6	Syrian Arab Republic	1,671	15.6	25.5	Bhutan	19	5.4	7.4
Kyrgyzstan	596	10.9	15.6	Myanmar	4,810	20.0	25.0	Cambodia	415	5.6	7.1
Bahrain	84	6.2	15.5	Brunei	34	16.3	24.6	Lao PDR	160	5.0	6.9
Syrian Arab Republic	2,050	9.7	15.1	Iraq	1,639	9.7	24.2	Kyrgyzstan	143	5.2	6.7
Iraq	2,269	6.7	14.0	Bahrain	64	7.5	21.3	Iraq	630	3.8	6.6
Lao PDR	543	8.5	13.2	State of Palestine	199	9.2	21.3	Mongolia	64	4.4	5.8
State of Palestine	255	6.0	13.0	Turkmenistan	399	15.7	21.2	Turkmenistan	125	4.8	5.6
Turkmenistan	524	10.1	12.7	Cambodia	796	11.2	20.7	Syrian Arab Republic	379	3.6	5.3
Cambodia	1,211	8.4	12.4	Lao PDR	383	12.0	20.6	United Arab Emirates	35	1.4	5.2

Table 1 (*continued*)

Table 1 (*continued*)

Lung-estimated incidence, all ages: both sexes				Lung-estimated incidence, all ages: male				Lung-estimated incidence, all ages: female			
Population	Numbers	Crude rate	ASR (W)	Population	Numbers	Crude rate	ASR (W)	Population	Numbers	Crude rate	ASR (W)
Nepal	2,499	8.1	12.3	Azerbaijan	885	19.0	20.2	State of Palestine	56	2.7	5.2
Azerbaijan	1,122	11.9	11.5	Bangladesh	8,728	11.3	16.6	Tajikistan	121	3.4	5.1
Qatar	79	4.1	10.7	Nepal	1,310	8.5	14.8	Islamic Republic of Iran	1,581	4.2	5.0
Bangladesh	10,851	7.1	10.0	Qatar	69	4.7	13.4	Kuwait	24	2.1	4.8
United Arab Emirates	181	2.2	9.4	Maldives	16	9.8	13.2	Georgia	198	8.7	4.8
Uzbekistan	1,681	6.0	8.0	Uzbekistan	1,250	9.0	13.1	Azerbaijan	237	5.0	4.3
Kuwait	105	3.6	8.0	United Arab Emirates	146	2.6	11.2	Qatar	10	2.1	4.1
Maldives	18	5.6	7.7	India	53,728	8.3	11.0	Jordan	77	2.5	4.1
Tajikistan	325	4.6	7.7	Tajikistan	204	5.9	10.9	Uzbekistan	431	3.1	3.7
Islamic Republic of Iran	4,888	6.5	7.7	Afghanistan	734	4.2	10.3	Bangladesh	2,123	2.8	3.6
India	70,275	5.6	6.9	Islamic Republic of Iran	3,307	8.6	10.3	Afghanistan	255	1.6	3.4
Bhutan	38	5.1	6.9	Kuwait	81	4.7	9.9	Sri Lanka	427	4.0	3.1
Afghanistan	989	3.0	6.9	Sri Lanka	1,149	11.0	9.8	India	16,547	2.7	3.1
Sri Lanka	1,576	7.4	6.2	Pakistan	5,772	6.3	9.7	Oman	16	1.3	2.8
Pakistan	6,800	3.8	5.8	Saudi Arabia	618	3.9	7.3	Saudi Arabia	206	1.6	2.7
Oman	76	2.6	5.1	Oman	60	3.5	6.7	Maldives	2	1.2	1.8
Saudi Arabia	824	2.9	5.1	Bhutan	19	4.8	6.5	Pakistan	1,028	1.2	1.7
Yemen	407	1.6	3.8	Yemen	309	2.4	6.4	Yemen	98	0.8	1.7

Standardized incidence rate and HDI

A positive correlation was seen between the standardized incidence rate of lung cancer and HDI about 0.345. This association was statistically significant (P=0.019). There was also a positive correlation between the standardized incidence rate of the cancer and components of HDI. In other words, there was a positive correlation between the standardized incidence rate and life expectancy at birth about 0.305 (P=0.039), positive correlation between mean years of schooling and life expectancy at birth about 0.310 (P=0.036), and positive correlation between the level of income per each person of the population and life expectancy at birth equal to 0.057 (P=0.707) (*Figure 2*).

In men, a positive correlation of 0.301 was observed between the standardized incidence rate of lung cancer and HDI. It was statistically significant (P=0.042). There was a positive correlation between the standardized incidence rate and life expectancy at birth about 0.242 (P=0.105), positive correlation between mean years of schooling and life expectancy at birth about 0.359 (P=0.014), and positive correlation between the level of income per each person of the population and life expectancy at birth equal to 0.045 (P=0.767).

In women, a positive correlation of 0.3 was observed between the standardized incidence rate of lung cancer and HDI. It was statistically significant (P=0.043). A positive correlation was seen between the standardized incidence rate of the cancer and components of HDI, but not significantly. There was a positive correlation between

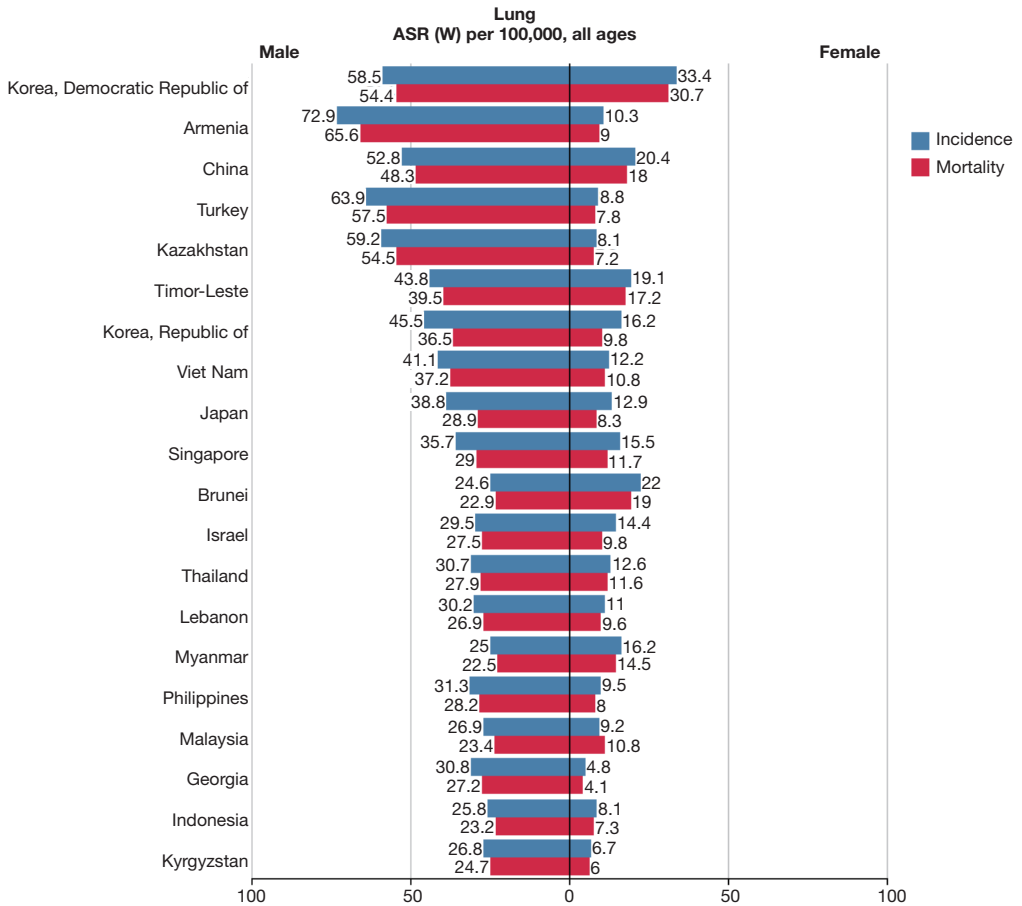

Figure 1 Standardized and incidence rates of mortality of lung cancer in 20 Asian countries with the highest standardized and incidence rates in 2012. ASR, age-specific incidence and mortality rate.

the standardized incidence rate and life expectancy at birth about 0.289 (P=0.051), positive correlation between mean years of schooling and life expectancy at birth about 0.143 (P=0.344), and positive correlation between the level of income per each person of the population and life expectancy at birth equal to 0.177 (P=0.241).

The standardized mortality rate and HDI

There was between the standardized mortality rate for lung cancer and HDI a positive correlation of 0.289 (P=0.052), expectancy at birth a positive correlation of 0.249 (P=0.095), mean years of schooling a positive correlation equal to 0.263 (P=0.077), and the level of income per each person of population a positive correlation of 0.014 (P=0.926), but not significantly (*Figure 3*).

In men, there was between the standardized mortality rate for lung cancer and HDI a positive correlation of 0.265 (P=0.075), expectancy at birth a positive correlation of 0.205 (P=0.173), mean years of schooling a positive correlation equal to 0.333 (P=0.024), and the level of income per each person of population a positive correlation of 0.072 (P=0.634), statistically significant.

In women, there was between the standardized mortality rate for lung cancer and HDI a positive correlation of 0.200 (P=0.182), expectancy at birth a positive correlation of 0.195 (P=0.195), mean years of schooling a positive correlation equal to 0.05 (P=0.744), and the level of income per each person of population a positive correlation of 0.109 (P=0.470), but not significantly.

Discussion

Our findings showed that in 2012, 1,033,881 cases of lung

Table 2 Number, crude and standardized mortality rates for lung cancer in Asian countries in 2012 (sorted by age standardized rates from highest to lowest)

Lung-estimated mortality, all ages: both sexes				Lung-estimated mortality, all ages: male				Lung-estimated mortality, all ages: female			
Population	Numbers	Crude rate	ASR (W)	Population	Numbers	Crude rate	ASR (W)	Population	Numbers	Crude rate	ASR (W)
Democratic People's Republic of Korea	12,759	52.0	40.9	Armenia	1,171	80.9	65.6	Democratic People's Republic of Korea	5,973	47.8	30.7
China	597,182	43.9	32.5	Turkey	18,953	51.0	57.5	Brunei	23	11.2	19.0
Armenia	1,420	45.7	32.0	Kazakhstan	3,454	43.9	54.5	China	175,487	26.8	18.0
Turkey	21,915	29.4	31.1	Democratic People's Republic of Korea	6,786	56.3	54.4	Timor-Leste	52	8.9	17.2
Timor-Leste	163	13.7	27.9	China	421,695	59.7	48.3	Myanmar	3,276	13.3	14.5
Kazakhstan	4,221	25.8	25.3	Timor-Leste	111	18.3	39.5	Singapore	507	19.4	11.7
Viet Nam	19,559	21.8	22.6	Viet Nam	14,401	32.4	37.2	Thailand	5,815	16.4	11.6
Republic of Korea	17,848	36.7	21.3	Republic of Korea	12,783	52.8	36.5	Viet Nam	5,158	11.4	10.8
Brunei	54	13.1	20.4	Singapore	1,083	40.9	29.0	Malaysia	1,351	9.3	10.8
Singapore	1,590	30.2	19.8	Japan	53,752	87.3	28.9	Israel	623	16.0	9.8
Thailand	17,669	25.3	19.1	Philippines	7,667	15.9	28.2	Republic of Korea	5,065	20.8	9.8
Myanmar	7,544	15.5	18.1	Thailand	11,854	34.5	27.9	Lebanon	240	10.9	9.6
Israel	1,956	25.4	17.9	Israel	1,333	35.1	27.5	Nepal	1,063	6.8	9.4
Lebanon	799	18.6	17.5	Georgia	834	41.2	27.2	Armenia	249	15.0	9.0
Japan	75,119	59.4	17.4	Lebanon	559	26.7	26.9	Japan	21,367	32.9	8.3
Philippines	10,369	10.7	17.0	Mongolia	213	15.2	26.1	Philippines	2,702	5.6	8.0
Malaysia	4,134	14.1	17.0	Kyrgyzstan	400	14.9	24.7	Turkey	2,962	7.9	7.8
Mongolia	272	9.6	14.8	Jordan	452	13.6	24.1	Bahrain	18	3.5	7.6
Indonesia	30,904	12.6	14.6	Malaysia	2,783	18.7	23.4	Indonesia	8,379	6.8	7.3
Kyrgyzstan	527	9.7	14.2	Indonesia	22,525	18.5	23.2	Kazakhstan	767	9.0	7.2
Jordan	522	8.1	14.1	Syrian Arab Republic	1,489	13.9	22.9	Bhutan	18	5.1	7.2
Georgia	1,011	23.5	13.9	Brunei	31	14.9	22.9	Cambodia	370	5.0	6.4
Syrian Arab Republic	1,826	8.6	13.5	Myanmar	4,268	17.8	22.5	Lao PDR	139	4.4	6.2
Iraq	2,028	6.0	12.6	Iraq	1,465	8.7	21.9	Kyrgyzstan	127	4.6	6.0
Bahrain	64	4.7	12.4	Turkmenistan	357	14.0	19.7	Iraq	563	3.4	5.9
Lao PDR	472	7.4	11.8	State of Palestine	178	8.2	19.3	Mongolia	59	4.1	5.5
Turkmenistan	470	9.1	11.7	Cambodia	707	10.0	19.1	Turkmenistan	113	4.3	5.1
State of Palestine	227	5.3	11.7	Azerbaijan	774	16.6	18.6	United Arab Emirates	31	1.2	5.0
Cambodia	1,077	7.4	11.3	Lao PDR	333	10.5	18.5	Tajikistan	111	3.1	4.8

Table 2 (*continued*)

Table 2 (*continued*)

Lung-estimated mortality, all ages: both sexes				Lung-estimated mortality, all ages: male				Lung-estimated mortality, all ages: female			
Population	Numbers	Crude rate	ASR (W)	Population	Numbers	Crude rate	ASR (W)	Population	Numbers	Crude rate	ASR (W)
Nepal	2,235	7.2	11.1	Bahrain	46	5.4	16.5	Syrian Arab Republic	337	3.2	4.7
Azerbaijan	992	10.5	10.5	Bangladesh	7,796	10.1	14.8	State of Palestine	49	2.3	4.7
Qatar	71	3.7	10.2	Nepal	1,172	7.6	13.3	Islamic Republic of Iran	1,411	3.8	4.5
Bangladesh	9,725	6.4	9.0	Maldives	16	9.8	13.2	Qatar	10	2.1	4.1
United Arab Emirates	153	1.9	8.9	Qatar	61	4.1	12.7	Georgia	177	7.8	4.1
Maldives	18	5.6	7.7	Uzbekistan	1,156	8.3	12.3	Azerbaijan	218	4.6	3.9
Uzbekistan	1,546	5.5	7.5	United Arab Emirates	122	2.2	10.6	Jordan	70	2.2	3.7
Tajikistan	297	4.2	7.2	Tajikistan	186	5.4	10.2	Kuwait	19	1.6	3.4
Islamic Republic of Iran	4,361	5.8	6.9	India	48,697	7.5	9.9	Uzbekistan	390	2.8	3.4
Bhutan	36	4.8	6.7	Afghanistan	649	3.8	9.4	Bangladesh	1,929	2.6	3.3
Kuwait	84	2.9	6.4	Islamic Republic of Iran	2,950	7.7	9.1	Afghanistan	227	1.4	3.1
India	63,759	5.1	6.3	Pakistan	5,097	5.6	8.7	India	15,062	2.5	2.9
Afghanistan	876	2.6	6.2	Sri Lanka	1,021	9.8	8.6	Oman	16	1.3	2.8
Sri Lanka	1,404	6.6	5.5	Kuwait	65	3.8	8.3	Sri Lanka	383	3.6	2.8
Pakistan	6,013	3.3	5.2	Saudi Arabia	548	3.5	6.7	Saudi Arabia	186	1.4	2.5
Oman	70	2.4	4.8	Bhutan	18	4.5	6.3	Maldives	2	1.2	1.8
Saudi Arabia	734	2.6	4.7	Oman	54	3.1	6.1	Pakistan	916	1.0	1.6
Yemen	361	1.4	3.4	Yemen	275	2.1	5.8	Yemen	86	0.7	1.5

Table 3 Human Development Index and its components in Asian countries in 2012

Population	HDI	Life expectancy at birth (years)	Mean year of schooling (years)	GNI per capita ($)
Very high human development				
Japan	0.912	83.6	11.6	32,545
Republic of Korea	0.909	80.7	11.6	28,231
Israel	0.900	81.9	11.9	26,224
Singapore	0.895	81.2	10.1	52,613
Brunei	0.855	78.1	8.6	45,690
Qatar	0.834	78.5	7.3	87,478
United Arab Emirates	0.818	76.7	8.9	42,716
High human development				
Bahrain	0.796	75.2	9.4	19,154
Kuwait	0.790	74.7	6.1	52,793
Saudi Arabia	0.782	74.1	7.8	22,616

Table 3 (*continued*)

Table 3 (*continued*)

Population	HDI	Life expectancy at birth (years)	Mean year of schooling (years)	GNI per capita ($)
Malaysia	0.769	74.5	9.5	13,676
Kazakhstan	0.754	67.4	10.4	10,451
Georgia	0.745	73.9	12.1	5,005
Lebanon	0.745	72.8	7.9	12,364
Islamic Republic of Iran	0.742	73.2	7.8	10,695
Azerbaijan	0.734	70.9	11.2	8,153
Oman	0.731	73.2	5.5	24,092
Armenia	0.729	74.4	10.8	5,540
Turkey	0.722	74.2	6.5	13,710
Sri Lanka	0.715	75.1	9.3	5,170
Medium human development				
Jordan	0.700	73.5	8.6	5,272
China	0.699	73.7	7.5	7,945
Turkmenistan	0.698	65.2	9.9	7,782
Thailand	0.690	74.3	6.6	7,722
Maldives	0.688	77.1	5.8	7,478
Mongolia	0.675	68.8	8.3	4,245
State of Palestine	0.670	73.0	8.0	3,359
Philippines	0.654	69.0	8.9	3,752
Uzbekistan	0.654	68.6	10.0	3,201
Syrian Arab Republic	0.648	76.0	5.7	4,674
Indonesia	0.629	69.8	5.8	4,154
Kyrgyzstan	0.622	68.0	9.3	2,009
Tajikistan	0.622	67.8	9.8	2,119
Viet Nam	0.617	75.4	5.5	2,970
Iraq	0.590	69.6	5.6	3,557
Timor-Leste	0.576	62.9	4.4	5,446
India	0.554	65.8	4.4	3,285
Cambodia	0.543	63.6	5.8	2,095
Lao PDR	0.543	67.8	4.6	2,435
Bhutan	0.538	67.6	2.3	5,246
Low human development				
Bangladesh	0.515	69.2	4.8	1,785
Pakistan	0.515	65.7	4.9	2,566
Myanmar	0.498	65.7	3.9	1,817
Nepal	0.463	69.1	3.2	1,137
Yemen	0.458	65.9	5.3	928
Afghanistan	0.374	49.1	3.1	1,000
Other countries or territories				
Democratic People's Republic of Korea	–	–	–	–

HDI, Human Development Index; GNI, gross national income.

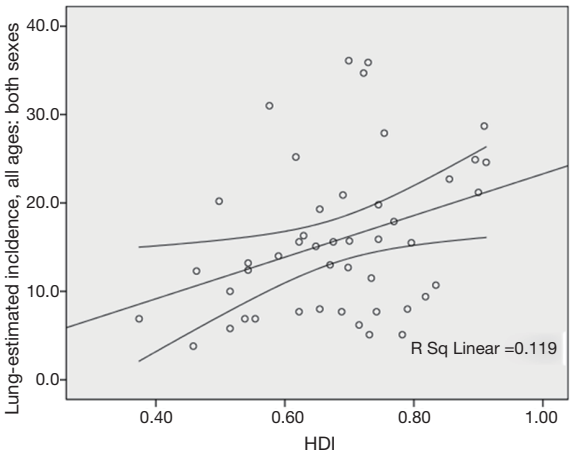

Figure 2 Correlation between HDI and standardized incidence of lung cancer in Asia in 2012. HDI, Human Development Index.

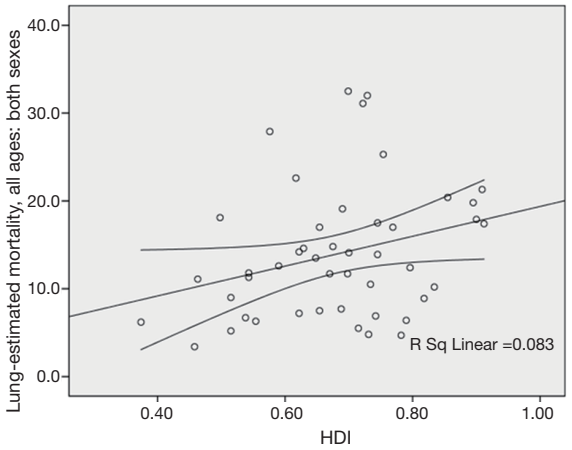

Figure 3 Correlation between HDI and standardized mortality rates for lung cancer in Asia in 2012. HDI, Human Development Index.

cancer occurred only in Asia. These included 56% of all cancer cases in the world. In this year, there were 926,436 deaths due to lung cancer in Asia, so that included 58% of all deaths due to cancer in the world (3).

This study showed that the highest incidence of lung cancer was related to the countries as Democratic Republic of Korea, China, Armenia, and Turkey. The greatest rates of mortality from lung cancer were related to the Democratic Republic of Korea, China, Armenia, and Turkey. Other studies have found that high incidence of lung cancer deaths from it in this country could be due to high cigarette consumption (13-16) accurate registration system for cancer (13), as well as the lifestyle of people. However, HDI is higher than 0.7 in these countries. As this indicator increase in these countries, the incidence and mortality from lung cancer rises.

According to the result of our study and other studies, HDI can be used as an independent predictor of lung cancer (17). Studies have demonstrated that lung cancer is seen more in higher social classes. In other words, the cancer is more common in the countries with high social level, on average (18). In this study, there was a direct relationship between the standardized mortality rate and the incidence rate of lung cancer. The relationship between the HDI and lung cancer is more in women than men. The incidence of lung cancer in women was positively correlated with areas of high HDI (9), which was consistent with the results of this study. This may be due to epidemiological transition, so that lung cancer is rising in women (19,20).

It is important to know that the geographical distribution of cancer, estimation, incidence and mortality from it is dependent on social development of regions. More than two thirds of cancer cases have been reported from countries with HDI above 0.9, probability due to better diagnostic techniques and accurate cancer registry (17).

The incidence of lung cancer increases along with the development, so that the cancer incidence is more in developed countries than less developed countries (21,22). Studies indicated that the burden of disease from lung cancer is more in countries with high HDI than others (23). Many factors may be effective. In developed countries than less developed countries, lung cancer may be more detected and recorded because of health system and infrastructure suitable for the diagnosis, a population registration system, as well as lifestyle (7,24). Considering epidemiological transition for smoking, in the future lung cancer in less developed countries, especially in women, is expected to increase (25).

In low HDI countries, the risk of viruses such as HPV, H. pylori, HIV, HBV, HCV related to types of cancer is more and it is expected to increase cancers associated with these viral agents, such as liver, stomach, and uterine cancers. Conversely, in the high HDI countries, it is expected to elevate risk of other cancers, including lung cancer most affected by people's lifestyle (17,20,26). Baray also expressed that in high HDI countries, lung cancer is the most common cancer in comparison with countries with low HDI. On the contrary, in countries with low HDI cancers associated with biological agents such as cervical cancer are more (17).

There are few studies to examine the relationship between macroeconomic determinants and Incidence, mortality and survival of different types of cancers. Studies that examine the relationship between HDI and its components with various types of cancer are low. Evaluation of the burden of cancer by HDI and its components can be very useful because shows a clearer picture of the distribution of cancer in each country according to the HDI and can be used to control cancer.

In this study, significant positive correlation was found between the standardized incidence and death rates, and the mean years of schooling. There was also a positive and significant relationship in men, although this relationship was not significant in women. In other studies (27), a conversely relationship was obtained between the level of education and lung cancer; the higher education, the lower incidence and death in both sexes (28-31).

People with more education pay more attention to your health and avoid high-risk behavior such as smoking. Therefore, it is expected an inverse relationship between lung cancer and the level of education.

Positive relationships between incidence and mortality rates of the cancer, and life expectancy confirmed that in countries where life expectancy is greater the probability of survival to older age is more and the risk of cancer increases because cancer occurs in old age and its causal factors in the long-term exposures show their effects (32).

Conclusions

The incidence of lung cancer has been increasing in Asia. It is high in men. Along with development, the incidence and mortality from lung cancer increases. It seems necessary to study reasons and factors of increasing the incidence and mortality of lung cancer in Asian countries.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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