

## ARTICLE INFO

Date Received:  
15/11/2019;  
Date Revised:  
12/02/2020;  
Date Published Online:  
25/02/2020;

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**How to Cite:**  
Lao TD, Le TAH (2020).  
Epidemiology, incidence and  
mortality of Nasopharynx  
Cancer in Southeast Asia: an  
update report. Adv. Life Sci.  
7(2): 86-90.

**Keywords:**  
Nasopharyngeal cancer;  
Epidemiology; Ecology,  
Southeast Asia

## Open Access



# Epidemiology, incidence and mortality of Nasopharynx Cancer in Southeast Asia: an update report

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## Abstract

**B**ackground: Nasopharyngeal cancer, with a distinct geographical and racial distribution, is the common neck and head cancer. Knowledge about the ecological factors including incidence, mortality, and so on, is important to find out the best way for its prevention in future. The aim of current study was to find out the incidence(-ASR), mortality(-ASR) of nasopharyngeal cancer and its correlation between those factors with HDI as well as its components in Southeast Asian countries in 2018.

**Methods:** The data of the incidence(-ASR), mortality(-ASR), Human development index (HDI) were extracted from the GLOBOCAN project and Human Development Reports database. The relationships were evaluated by using Pearson Correlation Coefficient method.

**Results:** In Southeast Asian region, incidence of 34,681, and mortality of 22,231 were recorded. The high incidence and mortality were related to medium human development countries. The significant positive correlations were observed between HDI with incidence-ASR ( $r = 6.25$ ,  $p = 0.04$ ) and mortality-ASR ( $r = 0.38$ ,  $p = 0.26$ ). No significant correlations were found between HDI component with incidence-ASR and mortality-ASR, except for the relationship between incidence-ASR and GNI/capita ( $r = 0.71$ ,  $p = 0.02$ ).

**Conclusion:** The nasopharyngeal cancer is native to Asian region, includes Southeast Asian countries. The highest incidence and mortality were recorded in medium HDI countries.



## Introduction

Nasopharyngeal cancer (NPC), arises from the epithelium of the nasopharynx, stands out from other epithelial cancers in the head and neck regions with a distinct geographical and racial distribution [1-5]. The main etiological factors include Epstein Barr Virus infection, genetic susceptibilities, environmental factors, lead to the nasopharyngeal cancer [1,5,6]. Worldwide, in 2012, 86,691 new nasopharyngeal cancer cases were recorded. Among them, 60,896 and 25,795 cases were recorded in men and women (sex ratio = 2.36), respectively [2,3,7]. In addition to the geographical distribution, according to the global cancer project in 2012, 68,272 cases, counting for more than 75% NPC patients were seen in Asia, so that 71.03%, 28.97% patients were seen in male, female, respectively, (sex ratio: 2.64). According to age-specific incidence rate (ASIR), the highest ASIR of NC countries were Malaysia, Singapore, Indonesia, Viet Nam and Brunei, which are belonged to Southeast Asia [3]. One of the reasons for the differences in nasopharyngeal cancer incidence and mortality in different populations are conventional personal attribute information such as age, gender, ethnicity, family history, and an additional attribute other factors, such as smoking, pollution, chemicals, Cantonese-style salted fish used in many Southeast countries [1,3-5,8].

Human development index (HDI), a summary measure of average achievement in key dimensions of human development, includes life expectancy index, education index, and gross national income per capita [9,10]. Furthermore, HDI is classified as four levels, includes low (HDI < 0.535), medium (0.710 ≥ HDI ≥ 0.535), high (0.80 > HDI > 0.710) and very high (HDI ≥ 0.80) level [2,9]. The low and very high HDI level indicates countries that are the lease developed and the most developed countries [9]. To now, the HDI classification is considered as the useful criteria to make the comparison between the incidence, and mortality of many human diseases, includes cancer, in worldwide population. The association between HDI and the incidence, mortality of human cancers has been previously studied [9,10-13]. The known its association could lead to the accurate understanding of human cancer's distribution [11]. Because the nasopharyngeal cancer incidence and mortality have been annually increasing in Southeast Asian countries, therefore, informing about the incidence, morality rate of nasopharyngeal cancer in the cancer prevention program is very important. Since the information about the nasopharyngeal cancer incidence, mortality rate in Southeast Asian countries could be useful applied for health program and research activities, current study aimed to determine the incidence, mortality of nasopharyngeal cancer, and its association with the HDI and its components in Southeast Asia in 2018.

## Methods

### Study design

The current ecological study is performed to evaluate the correlation between HDI as well as its components, includes life expectancy at birth, mean years of schooling and gross national income per capita (GIN), and age-specific incidence and mortality of nasopharyngeal cancer in Southeast Asian countries. Data of age-specific incidence and mortality of nasopharyngeal cancer in 2018 was obtained from the global cancer observatory for each countries in Southeast Asia, available from <http://gco.iarc.fr/today/home> [14]. Data of HDI and its components were collected from Human Development Reports database, United Nations Development Program, available from <http://hdr.undp.org/en/data> [15].

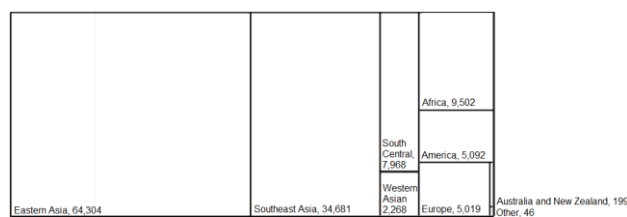
### Statistical analysis

In current study, the Pearson Correlation Coefficient method was performed to assess the correlation between ASR with HDI and its components. Statistical significance was assumed if the p-value < 0.05.

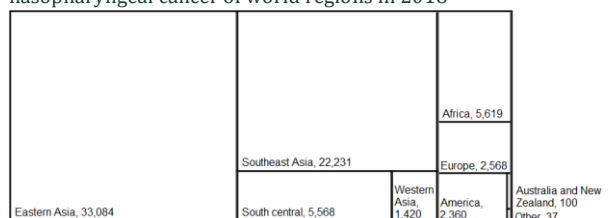
## Results

### Finding nasopharyngeal cancer case, HDI and its components

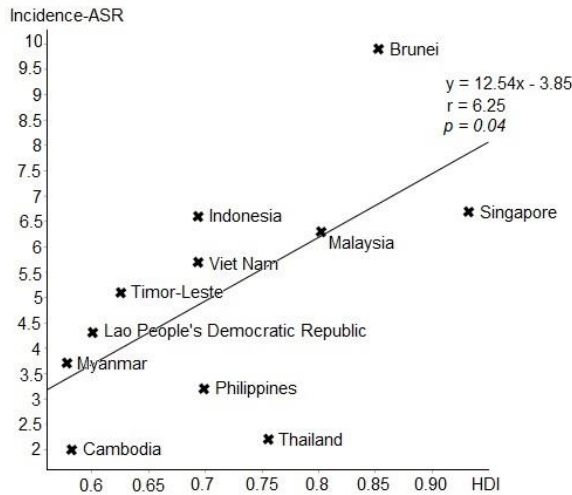
Generally, in 2018, a total of 129,079 new nasopharyngeal cases were recorded in the world, of which 93,416 cases (counting for 72.37%) were diagnosed in male, and 35,663 cases (counting for 27.63%) were diagnosed in female. This data figured out the male/female ratio is 2.62 : 1. A total of 72,987 nasopharyngeal death cases were occurred in the world, so that 54,280 nasopharyngeal death cases (counting for 74.37%) were recorded in male, 18,707 death cases (counting for 25.63%) were seen in female (sex ratio: 2.90 : 1). In Southeast Asian region, a total of 34,681 new cases (Fig. 1), of which 25,895 cases (counting for 74.67%) and 8,786 cases (counting for 25.33%) were diagnosed in male, and female (sex ratio: 2.95 : 1), respectively, were seen. 22,231 nasopharyngeal death cases were recorded (Fig. 2). Among them, 15,057 death cases and 5,174 death cases were seen in male, female, (ratio: 2.91 : 1) respectively.



**Figure 1:** The hierarchy chart indicated the incidence of nasopharyngeal cancer of world regions in 2018



**Figure 2:** The hierarchy chart indicated the mortality of nasopharyngeal cancer of world regions in 2018



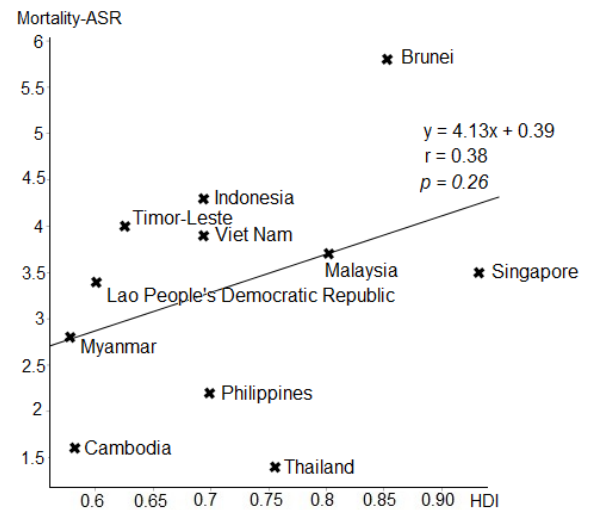
**Figure 3:** Correlation between HDI and incidence-ASR of nasopharynx cancer in Southeast Asian countries in 2018

Individually, the incidence and mortality of the Southeast Asian countries according to sex were shown in table 1. Furthermore, the Age-world-standardized incidence rate (incidence-ASR), crude incidence, the Age-world-standardized mortality rate (mortality-ASR), crude mortality of nasopharyngeal cancer according to both sexes, male and female in Asian countries were shown in table 2, table 3. The five countries with the highest standardized incidence rate of nasopharyngeal cancer are as follows: (1) Brunei: with the highest Incidence-ASR of 9.9 per 100,000 people; (2) Singapore: 6.7 per 100,000 people; (3) Indonesia: 6.6 per 100,000 people; (4) Malaysia: 6.3 per 100,000 people; and (5) Viet Nam: 5.7 per 100,000 people. The five countries with the highest standardized mortality rate of nasopharyngeal cancer are as follows: (1) Brunei: with the highest mortality-ASR of 5.8 per 100,000 people; (2) Indonesia: 4.3 per 100,000 people; (3) Timor-Leste: 4.0 per 100,000 people; (4) Viet Nam: 3.9 per 100,000 people; and (5) Malaysia: 3.7 per 100,000 people. The values of HDI and its components of Southeast Asian countries were shown in table 4. Of them, Singapore is the country with the highest HDI of 0.932. According to HDI, Southeast Asian countries were classified in three categories of human development level as follows: three countries in very high human development category, includes Singapore, Brunei, Malaysia; one country in high category, includes Thailand; seven countries in medium category, includes Philippines, Indonesia, Viet Nam, Timor-Leste, Lao People's Democratic Republic, Cambodia and Myanmar.

**Evaluating the association between incidence-ASR, mortality-ASR and HDI**

The result of correlation analysis showed the moderate positive correlation between incidence-ASR and HDI ( $r = 0.625$ ) (Fig. 3, Table 5). This correlation was statistically significant ( $p = 0.04$ ). In addition, the analysis result showed the weak positive correlation between mortality-

ASR and HDI ( $r = 0.38$ ). However, this correlation was not statistically significant ( $p = 0.26$ ) (Fig. 4, Table 5). The analyzed results of relationship between incidence-ASR, mortality-ASR with HDI components were shown in Table 5. As the results, there were positive correlation between incidence-ASR, mortality with HDI components, includes Life expectancy at birth, mean year of schooling and GNI/capita. However, only the relationship between incidence-ASR with GNI/capita was statistically significant ( $p = 0.02$ ).



**Figure 4:** Correlation between HDI and Mortality-ASR of nasopharynx cancer in Southeast Asian countries in 2018

**Discussion**

Nasopharyngeal cancer is a rare cancer among other populations in the world, except for high incidence and mortality in Asia. Many studies on the etiology of nasopharyngeal cancer have strongly suggested it has a remarkable ethnic and distinct geographical distribution [1-5,16,17]. Overall, 34,681 new cases and 22,231 deaths attributed to nasopharyngeal cancer in Southeast Asian countries in 2018. Among them, three highest incidences of nasopharyngeal cancer are as follows: (1) Indonesia: 17,992 cases; (2) Viet Nam: 6,212 cases; (3) Philippines: 2,913 cases. Three highest mortality of nasopharyngeal cancer are as follows: (1) Indonesia: 11,204 cases; (2) Viet Nam: 4,232 cases; (3) Philippines: 1,899 cases. So that, the high incidence of nasopharyngeal cancer in human medium development countries is higher than high and very high development countries (Table 1, 4), and this is distributed to environment with a high relative of risk factors related to the carcinogenesis, less budget allocations for health care and public health sectors, includes population incomes, educations and health services [2,3,18]. Due to lack of health service and the diagnosis of most of cases were on the advantage stage, the high mortality was observed more in these areas.

In this study, the significant positive correlation was found between incidence-ASR, mortality-ASR with HDI (Table 5).

Countries	Incidence				Mortality			
	Cases	Rank	%	Cum. risk	Cases	Rank	%	Cum. risk
Indonesia	17,992	1	51.88	0.73	11,204	1	50.40	0.52
Viet Nam	6,212	2	17.91	0.64	4,232	2	19.04	0.47
Philippines	2,913	3	8.40	0.34	1,899	3	8.54	0.25
Thailand	2,200	4	6.34	0.24	1,421	5	6.39	0.16
Malaysia	2,089	5	6.02	0.68	1,187	6	5.34	0.44
Myanmar	2,084	6	6.01	0.42	1,527	4	6.87	0.34
Singapore	623	7	1.80	0.73	345	7	1.55	0.43
Cambodia	256	8	0.74	0.23	198	8	0.89	0.20
Lao People's Democratic Republic	226	9	0.65	0.50	165	9	0.74	0.41
Timor-Leste	44	10	0.13	0.58	31	10	0.14	0.47
Brunei	42	11	0.12	1.92	22	11	0.10	0.85
<b>Total</b>	<b>34,681</b>	<b>-</b>	<b>100.00</b>	<b>0.55</b>	<b>22,231</b>	<b>-</b>	<b>100.00</b>	<b>0.37</b>

**Table 1:** The incidence and mortality of nasopharyngeal cancer of the Southeast Asian countries in 2018 (sorted by the incidence rate from the highest to lowest value)

Note: Cumulative risk (the risk of developing a specific type of cancer at a certain age in the absence of any other cause of death)

Countries	Incidence - both sexes			Incidence - male			Incidence - female		
	ASR	Rank	Crude rate	ASR	Rank	Crude rate	ASR	Rank	Crude rate
Brunei	9.9	1	9.7	12.7	1	12.1	6.9	1	7.1
Singapore	6.7	2	10.8	9.8	3	15.0	3.7	2	6.6
Indonesia	6.6	3	6.7	10.5	2	10.4	2.9	6	3.0
Malaysia	6.3	4	6.5	9.5	4	9.7	3.0	5	3.2
Viet Nam	5.7	5	6.4	9.0	5	9.5	2.8	7	3.4
Timor-Leste	5.1	6	3.3	7.1	6	4.5	3.2	3	2.1
Lao People's Democratic Republic	4.3	7	3.2	5.8	7	4.1	3.1	4	2.4
Myanmar	3.7	8	3.9	5.5	8	5.4	2.2	8	2.4
Philippines	3.2	9	2.7	4.6	9	3.7	2.0	9	1.8
Thailand	2.2	10	3.2	3.3	10	4.7	1.2	10	1.8
Cambodia	2.0	11	1.6	3.2	11	2.2	1.0	11	0.9

**Table 2:** The Age-world-standardized incidence rate (incidence-ASR), crude incidence of nasopharyngeal cancer according to both sexes, male and female in Asian countries (sorted by the incidence-ASR – both sexes from the highest to lowest value)

Countries	Mortality - both sexes			Mortality - male			Mortality - female		
	ASR	Rank	Crude rate	ASR	Rank	Crude rate	ASR	Rank	Crude rate
Brunei	5.8	1	5.1	7.8	1	6.7	3.8	1	3.3
Indonesia	4.3	2	4.2	7.2	2	6.7	1.7	5	1.7
Timor-Leste	4.0	3	2.3	5.7	5	3.3	2.4	2	1.4
Viet Nam	3.9	4	4.4	6.5	3	6.6	1.9	4	2.7
Malaysia	3.7	5	3.7	5.7	5	5.6	1.7	5	1.7
Singapore	3.5	6	6.0	5.8	4	9.7	1.3	8	2.3
Lao People's Democratic Republic	3.4	7	2.4	4.7	7	3.1	2.3	3	1.7
Myanmar	2.8	8	2.8	4.4	8	4.1	1.5	7	1.6
Philippines	2.2	9	1.8	3.4	9	2.5	1.3	8	1.1
Cambodia	1.6	10	1.2	2.8	10	1.8	0.8	10	0.7
Thailand	1.4	11	2.1	2.2	11	3.1	0.7	11	1.0

**Table 3:** The Age-world-standardized mortality rate (mortality-ASR), crude mortality of nasopharyngeal cancer according to both sexes, male and female in Asian countries (sorted by the mortality-ASR – both sexes from the highest to lowest value)

	HDI	Rank	Human development level	Life expectancy at birth	Mean year of schooling	GNI/capita
Singapore	0.932	1	Very high human development	83.2	11.5	82,503
Brunei	0.853	2		77.4	9.1	76,427
Malaysia	0.802	3		75.5	10.2	26,107
Thailand	0.755	4	High human development	75.5	7.6	15,516
Philippines	0.699	5	Medium human development	69.2	9.3	9,154
Indonesia	0.694	6		69.4	8.0	10,846
Viet Nam	0.694	6		76.5	8.2	5,859
Timor-Leste	0.625	8		69.2	4.5	6,846
Lao People's Democratic Republic	0.601	9		67.0	5.2	6,070
Cambodia	0.582	10		69.3	4.8	3,413
Myanmar	0.578	11	66.7	4.9	5,567	

**Table 4:** HDI and its components in Southeast Asian countries in 2018 (sorted by the HDI from the highest to lowest value)

Variables		HDI	Life expectancy at birth	Mean year of schooling	GNI/capita
Incidence-ASR	r	6.25	0.50	0.51	0.71
	p	0.04	0.11	0.11	0.02
Mortality-ASR	r	0.38	0.27	0.27	0.50
	p	0.26	0.42	0.43	0.12

**Table 5:** Correlation between incidence-ASR, mortality-ASR with HDI and its components

Notably, based on the HDI, Singapore, Brunei and Malaysia were classified as highly developed countries (HDI  $\geq$  0.80). However, the higher incidence-ASR, mortality-ASR of those countries were found, compared to other high or medium human development countries, such as Thailand, Indonesia, Viet Nam, Myanmar, etc. (Table 2, 3; Fig. 3, 4). Among them, Brunei, highest incidence-ASR of 9.9, and mortality-ASR of 5.8 were recorded, compared to the incidence-ASR of 1.5 and mortality-ASR of 0.84. Furthermore, only a significant positive relationship was observed between incidence-ASR with HDI component: GNI/capita. Overall, it could be explained by the greater westernization effect, meant that the tobacco and air pollution were serious, due to the industrialization and consumption [7,19,20]. Additionally, the systems of epidemiological research and record in the medium human development level could be generally less robust, and it remains uncertain whether this observation could be attributed to reporting bias [7,19].

Nasopharyngeal cancer is gravitated to Asian region, includes Southeast Asian countries. The high incidence and mortality were related to medium human development countries, includes Philippines, Indonesia, Viet Nam, Timor-Leste, Lao People's Democratic Republic, Cambodia and Myanmar. It was significant positive correlation between HDI with incidence-ASR, mortality-ASR. However, this ecological study was focused on the Southeast Asian countries, thus, further studies are recommended in other regions of Asia in order to find out the ecology of nasopharyngeal cancer in Asia.

### Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this paper.

### Authors' Contribution

Both authors contributed equally to this study, drafting and publication of the manuscript.

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