RESEARCH ARTICLE

Editorial Process: Submission:03/01/2025 Acceptance:09/10/2025 Published:09/14/2025

Cancer Burden Across The South East Asia Nation (ASEAN) in 2022

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Abstract

Objective: This article aims to estimate the cancer burden in the ASEAN region by utilizing data from the 2022 Global Cancer Observatory (GCO). **Methods:** Using GCO data and its metric definition, we gathered cancer-related information for each ASEAN country and globally. Key metrics include incidence (new cases in 2022), mortality (cancer death in 2022), incidence per 100,000 (proportion diagnosed), mortality-to-incidence ratio (MIR) per 100,000 (proportion who died), age-standardized incidence rate(ASIR) per 100,000 (adjusted for age distribution), age-standardized mortality rate (ASMR) per 100,000 (adjusted mortality rate), and 5-year cancer prevalence (total cases from 2017-2022). **Result:** The region accounted for 9.3% of global cancer incidence, with Singapore having the highest Age-standardized incidence rate(ASIR) at 231.1 and Myanmar the lowest at 135.5. The Philippines had the highest Age-standardized mortality rate (ASMR) at 112.9, and Indoensia the lowest at 82.5. Breast cancer was the most common among females (ASIR: 41.8), while lung cancer had the highest ASIR among males (26.0). Throid cancer had the highest incidence and mortality-to-incidence ratio in female, while liver cancer had the highest mortality rate in males. Across ASEAN, breast cancer ranked among the top five cancer in all countries. The finding highlight variations in cancer incidence and mortality across the region, emphasizing the need for targered prevention and control strategies. **Conclusion:** Data from ASEAN countries highlight significant variation in cancer incidence (ASIR) and mortality (ASMR) rate. Breasrt cancer was the most highest ASIR cancer among country in ASEAN. Cancer influenced by factor such as lifestyle habits, socioeconomic conditions, healthcare infrastructure, and genetic predispositions. Major contributors to the rising cancer rates in the region include key risk factor like tobacco and alcohol use, obesity, physical inactivity, and poor dietary habits.

Keywords: Cancer- ASEAN- Burden of Disease

Asian Pac J Cancer Prev, **26 (9)**, 3377-3388

Introduction

Cancer is the leading cause of death and a barrier to increasing life expectancy, and in low-and middle-income country it is the second leading cause of death [1, 2]. According to a report from an analysis of World Health Organization (WHO) estimates in 2019, cancer was the third or fourth leading cause of death in 23 countries, and the leading cause of death in 112 countries in people under age 70. This makes cancer a disease with a high mortality rate compared to stroke and coronary heart disease [1]. Countries with significant increases in cancer cases, such as low- and middle-income countries (LMICs), are already making efforts to achieve sustainable cancer control [2]. Low- and middle-income countries (LMICs) account for 57% of cancer cases and experience high mortality rates, accounting for nearly two-thirds of cancer deaths globally [3].

The Association of Southeast Asian Nations (ASEAN), established on August 8, 1967, comprises 10 member countries: Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. Together, these nations have a total population of about 625 million, representing approximately 9% of the global population [4]. Similar to other regions worldwide, ASEAN faces a growing cancer burden due to an aging population and the adoption of Western lifestyles. It was recently estimated that there were over 700,000 new cases of cancer and 500,000 cancer deaths in ASEAN in the year 2008 [5]. These figures are anticipated to rise, emphasizing the urgent need for effective cancer prevention strategies and improved

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healthcare services [5, 6]. Despite the growing burden, many ASEAN governments have been slow to respond effectively, which has intensified the cancer crisis in the region. Recent research indicates that more than 75% of cancer patients in ASEAN experience either mortality or severe financial strain within the first year after diagnosis [6]. Nevertheless, several ASEAN Governments have been slow to react to this problem [7]. Understanding the overall cancer burden in this region is crucial for developing a unified regional strategy to meet the needs of cancer patients. Research on the cancer burden in ASEAN is often conducted using the DALY approach and focuses on specific cancers caused by smoking [7–9]. As far as our review has found, there are no articles that discuss the overall cancer burden in ASEAN using incidence and mortality rates along with ASIR and ASMR analyses. This article aims to estimate the cancer burden in the ASEAN region using data from the 2022 Global Cancer Observatory (GCO) by examining incidence and mortality rates, as well as analyzing the Age-standardized incidence rate(ASIR) and Age-standardized mortality rate (ASMR) to identify patterns, disparities, and potential priorities for cancer control in the region.

Materials and Methods

Data collection incidence of cancer using the Global Cancer Observatory

The Global Cancer Observatory (GCO), a project of the International Agency for Research on Cancer (IARC), is an online resource designed to provide policymakers, healthcare professionals, and the general public with precise data on the global cancer burden, including detailed statistics from countries around the world. Using GCO data and its metric definitions, we collected the following information for each country in the ASEAN region and globally; incidance define the number of new cancer cases identified in a specific population during 2022, mortality define the number of deaths caused by cancer in 2022, Incidence per 100,000 define as the proportion of people diagnosed with cancer in 2022, Mortality to Incidence Ratio (MIR) per 100,000 define the proportion of the population who died from cancer in 2022, Age-standardized incidence rate(ASIR) per 100,000 define the average incidence rate adjusted for age distribution, Age-standardized mortality rate (ASMR) per 100,000: The average mortality rate adjusted for age distribution and 5-Year Cancer Prevalence define as the total number of individuals living with cancer at any time between 2017 and 2022. To enable fair comparisons across countries with different age structures, this study employed age-standardized indicators including the Age-standardized incidence rate(ASIR), Age-standardized mortality rate (ASMR), and Mortality-to-Incidence Ratio (MIR). These measures allow for more accurate assessment of cancer burden and healthcare system performance across the ASEAN region [10, 11].

Estimating cancer burden in the South East Asian Countries

Through the Global Cancer Observatory (GCO), we gathered population data, including total, male, and female figures, for each country. To calculate the incidence, mortality, and 5-year prevalence rates for the entire region, we summed the respective case, death, and prevalence numbers across all ASEAN countries. Regional incidence rates, mortality to incidances rasio (MIR), age-standardized incidence rates (ASIR), and age-standardized mortality rates (ASMR) were computed by taking a weighted average based on each country's population. The mortality-to-incidence ratio (MIR) was calculated for each country, the total region, and globally by dividing the number of deaths by the number of new cases. This process was repeated separately for males and females. Crude rates were used for general data reporting by country, while ASIR and ASMR estimates facilitate comparisons of cancer incidence and mortality rates across different tumor types, sexes, and countries, as these adjust for age distribution differences. MIR is useful for comparing cancer outcomes and survival rates across countries, as it relies on more readily available incidence and mortality data. Additionally, we identified the 10 most common cancers by ASIR and the most common cancers by ASMR for both males and females.

The year 2022 was selected for analysis in this study as it represents the most recent data available. The data are presented in a descriptive format and analyzed using excel. Patients and the general public were not involved in the design, conceptualization, data collection, writing, or review of this manuscript

Results

Table 1 shows the 2022 cancer population statistics for the ASEAN region. The number of newly diagnosed cancer cases in the region accounted for 9.3% of the global incidence. Singapore had the highest Age-standardized incidence rate(ASIR) at 231.1, while Myanmar had the lowest at 135.5. This is consistent with the fact that the highest ASIR values for both females and males are in Singapore, at 231.0 and 235.9, respectively. In 2022, the population of ASEAN was estimated at 697,228,824, making up 8.52% of the global population, and South-Eastern Asia ranks number 3 in Asia among subregions ranked by population. Total cancer deaths were highest in Indonesia at 242,988, representing 12.4% of all cancer deaths globally, while the lowest number of cancer deaths was in Laos at 6,215. The total incidence of cancer is also influenced by the population size of each country. The Age-standardized mortality rate (ASMR) was greatest in the Philippines, with a rate of 112.9, and lowest in Indonesia, with a rate of 82.5.

Table 2 highlights the 10 most common types of cancers in the region. Thyroid cancer had the highest incidence as well as the highest mortality-to-incidence ratio in females. The highest mortality rate among males in the region was from liver cancer. All ASIRs by cancer site and sex are shown in Figure 1, and Figure 2 and Table 2 depict the five most common cancer sites by country in the region. The highest ASIR among females was for breast cancer at 41.8, while the lowest was for Non-Hodgkin Lymphoma (NHL) at 3.9. Among males,

Table 1. 2022 Population Statistics Of Cancer in the South East Asian Countries

Countries	Population no.	Incidence	ASIR	T. deaths	ASMR	five-years prevalance
All						
Brunei Darussalam	445.429	925	192.2	464	104.6	2.852
Cambodia	17,168,635	19.795	138.3	13.799	99.3	40.634
Indonesia	279,134,505	408.661	136.9	242.988	82.5	1,018,110
Laos	7,481,026	9.101	154.5	6.215	109.9	19.483
Malaysia	33,181,079	51.65	142.1	31.633	86.3	155.507
Myanmar	55,227,152	77.603	135.5	54.841	97.1	156.677
Philippines	112,508,991	118.976	185.4	113.369	112.9	466.012
Singapore	3,110,785	25.25	231.1	13.277	110.8	80.543
Thailand	70,078,198	183.541	154.4	118.829	93.4	441.9
Vietnam	98,953,535	180.48	150.8	120.184	99.0	409.144
World	7,885,070,781	19,976,499	196.9	9,743,832	91.7	53,504,187
Female						
Brunei Darussalam	214.578	529	216.0	235	104.2	1.765
Cambodia	8,783,294	10.624	130.0	6.649	83.4	23.695
Indonesia	138,626,115	220.266	141.6	114.248	73.9	620.125
Laos	3,725,946	4.522	143.9	2.671	89.4	10.695
Malaysia	16,144,748	26.758	148.0	14.653	79.9	92.326
Myanmar	28,610,634	41.781	129.8	27.323	85.1	90.968
Philippines	56,059,199	105.912	192.5	56.506	102.0	287.161
Singapore	2,832,766	11.908	231.0	5.618	92.9	41.956
Thailand	36,021,160	93.208	150.6	53.729	78.2	253.301
Vietnam	49,542,373	85.122	132.3	48.799	72.7	219.715
World	3,912,335,034	9,664,889	186.3	4,313,548	76.9	27,756,915
Male						
Brunei Darussalam	230.851	396	171.7	229	105.6	2.852
Cambodia	8,385,341	9.171	152.9	7.15	121.9	16.939
Indonesia	140,508,390	188.395	135.5	128.74	93.9	397.985
Laos	3,755,080	4.579	167.9	3.544	132.9	8.788
Malaysia	17,036,331	24.892	137.9	16.98	93.1	63.181
Myanmar	26,616,518	35.822	147.2	27.518	114.9	65.709
Philippines	56,449,792	83.064	184.6	56.863	129.3	178.851
Singapore	3,110,785	13.342	235.9	7.659	131.4	38.587
Thailand	34,057,038	90.333	161.6	65.1	112.4	188.599
Vietnam	49,411,162	95.358	177.1	71.385	132.6	189.429
World	3,972,735,747	10,311,610	212.6	5,430,284	109.8	25,747,272

T-death:total death; ASIR, Age-Standardized Incidence Rate; ASMR, Age-Standardized Mortality Rate

lung cancer had the highest average ASIR at 26.0, and lip and oral cavity cancer had the lowest at 3.4 (see Table 2 and Figure 1). Similar values were seen for ASMR, with breast cancer having the highest ASMR among females and lung cancer having the highest ASMR among males (Table 2). Table 3 shows the top 5 types of cancers with the highest ASIR values for each ASEAN country. The Philippines had the highest ASIR for breast cancer and for nearly all other cancer types compared to other countries. Breast cancer was among the top 5 cancers with the highest ASIR values across ASEAN countries. ASIR and ASMR for each country are shown in Figure 2 and Figure 3. Figure 4 shows a comparison of ASIR and ASMR values for each country in ASEAN.

Discussion

Using Global Cancer Observatory (GCO) data, we found that each ASEAN region has different incidence and mortality rates. The age-standardized incidence rate (ASIR) values range from 135.5 to 231.1, age-standardized mortality rate (ASMR) values range from 82.5 to 112.9, and the mortality-to-incidence ratio (MIR) in cancer sites for the female group ranges from 1.05 to 8.40, while for the male group, it ranges from 0.42 to 0.96. These findings can help ASEAN countries develop

Table 2. 2022 South East Asian Countries: cancer sites, statistics, and MIRs for females/males

Top 10 cancers	Incidence in SEA	ASIR	Mortality in SEA	ASMR	MIR in SEA	MIR
Female						
1	Breast	41.8	Breast	14.9	Thyroid	8.40
2	Cervix uteri	17.4	Cervix uteri	9.5	Corpus Uteri	3.47
3	Colorectum	11.9	Lung	8.4	Breast	2.81
4	Lung	9.6	Liver	6.5	Colorectum	1.92
5	Ovary	8.1	Colorectum	6.2	Cervix uteri	1.83
6	Thyroid	6.8	Ovary	5.1	NHL	1.70
7	Liver	6.8	Leukaemia	3.3	Ovary	1.59
8	Corpus uteri	6.6	Stomach	2.9	Leukaemia	1.39
9	Leukaemia	4.6	NHL	2.3	Lung	1.14
10	NHL	3.9	Corpus uteri	1.9	Liver	1.05
Males						
1	Lung	26.0	Lung	23.3	Liver	0.96
2	Liver	21.2	Liver	20.4	Lung	0.89
3	Colorectum	18.0	Colorectum	9.4	Stomach	0.82
4	Prostate	12.7	Stomach	5.6	Leukaemia	0.73
5	Nasopharynx	7.2	Prostate	5.3	Nasopharynx	0.69
6	Stomach	6.8	Nasopharynx	5.0	NHL	0.59
7	Leukaemia	6.2	Leukaemia	4.5	Lip, oral cavity	0.56
8	NHL	6.1	NHL	3.6	Colorectum	0.52
9	Bladder	4.2	Oesophagus	3.2	Bladder	0.50
10	Lip, oral cavity	3.4	Pancreas	2.8	Prostate	0.42

SEA, South East Asian; ASIR, Age-Standardized Incidence Rate; ASMR, Age-Standardized Mortality Rate; MIR, Mortality to Incidence Ratio

cancer control strategies both nationally and regionally through collaboration.

Brunei Darusalam

Brunei Darussalam has the second highest age-standardized incidence rate(ASIR) at 192.2 and a relatively high Age-standardized mortality rate (ASMR) of

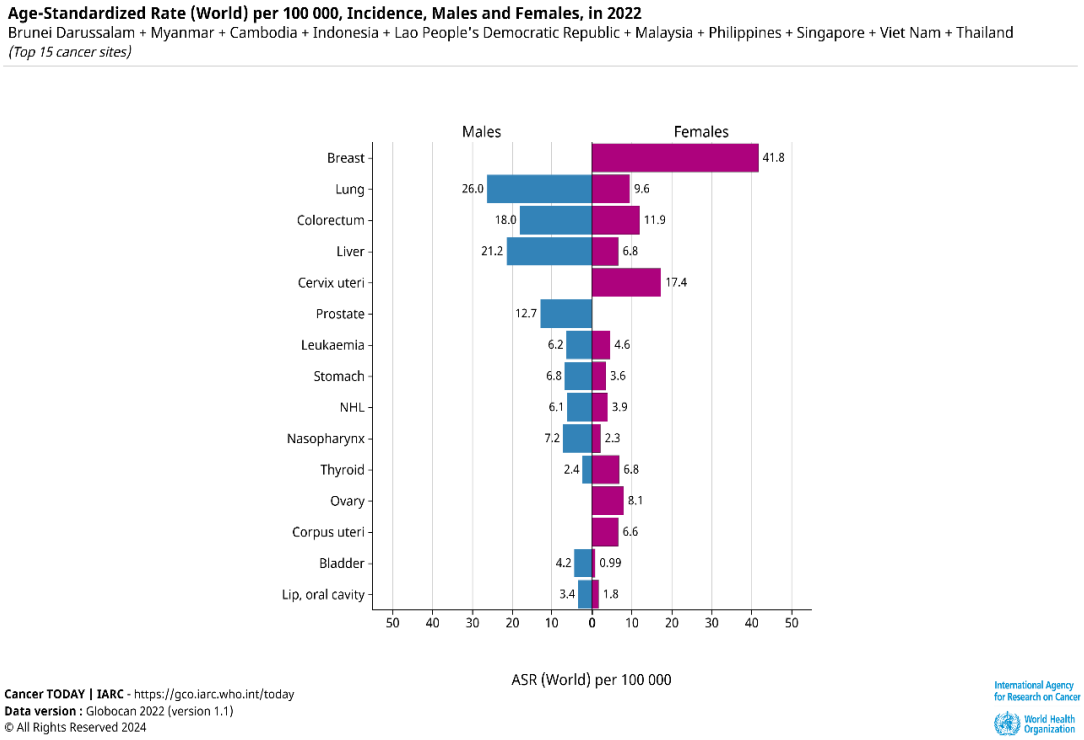

Figure 1. ASIR Cancer Site per 100,000; source: Global Cancer Obsercatory (IARC), 2022

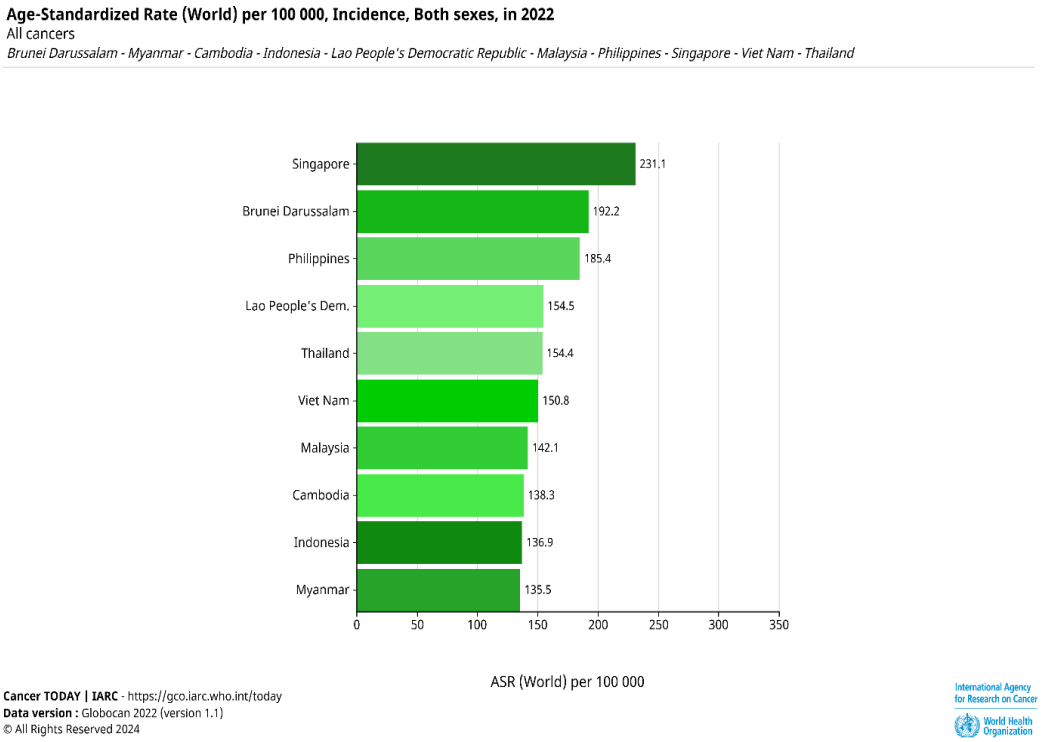

Figure 2. ASIR Cancer Country Per 100,000; source: Global Cancer Obsercatory (IARC), 2022

104.6, according to the data provided. The table highlights that Brunei has the highest ASIR for breast cancer, which is a significant concern in public health. Approximately 30% of Brunei woman are found to be obese, which is a notable factor in the increasing prevalence of breast cancer in the country [12].

Studies have shown that several lifestyle factors are associated with an elevated risk of breast cancer. These include tobacco use, alcohol consumption, physical inactivity, unhealthy diet, as well as excessive weight gain. Additionally, high plasma glucose levels, hormonal and reproductive factors, and genetic predispositions are also contributing factors to the rising incidence of breast cancer. These elements suggest a complex interplay of

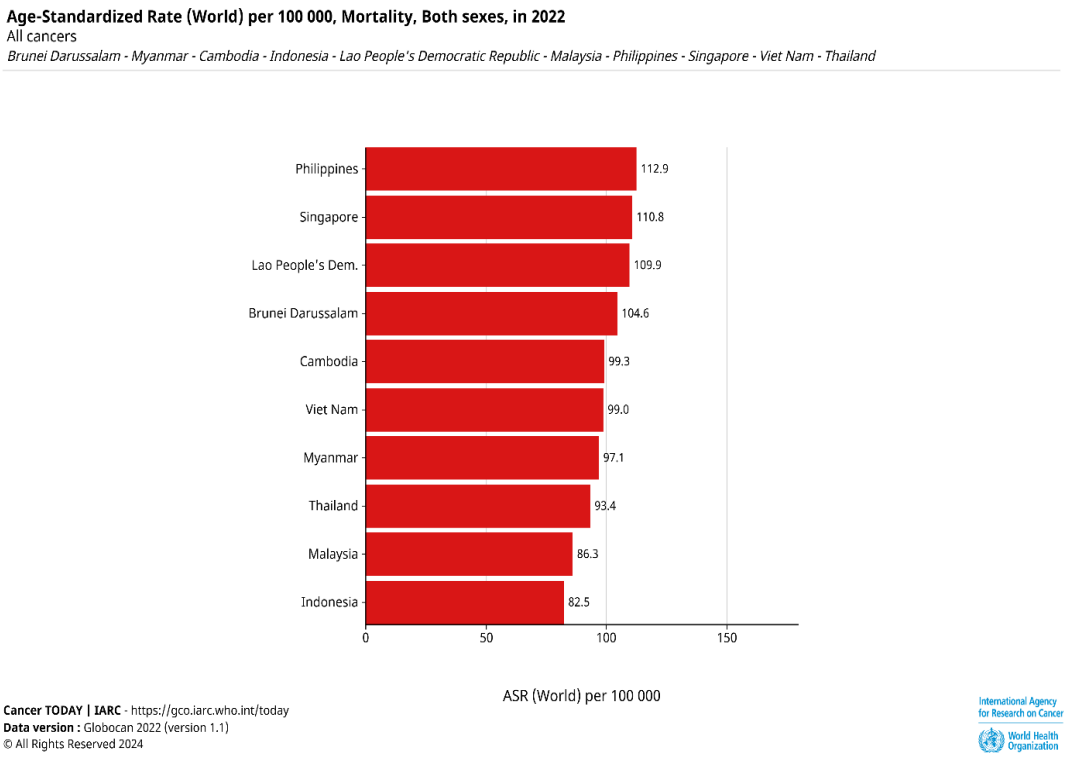

Figure 3. ASMR Cancer Site Per 100,000;source: Global Cancer Obsercatory (IARC), 2022

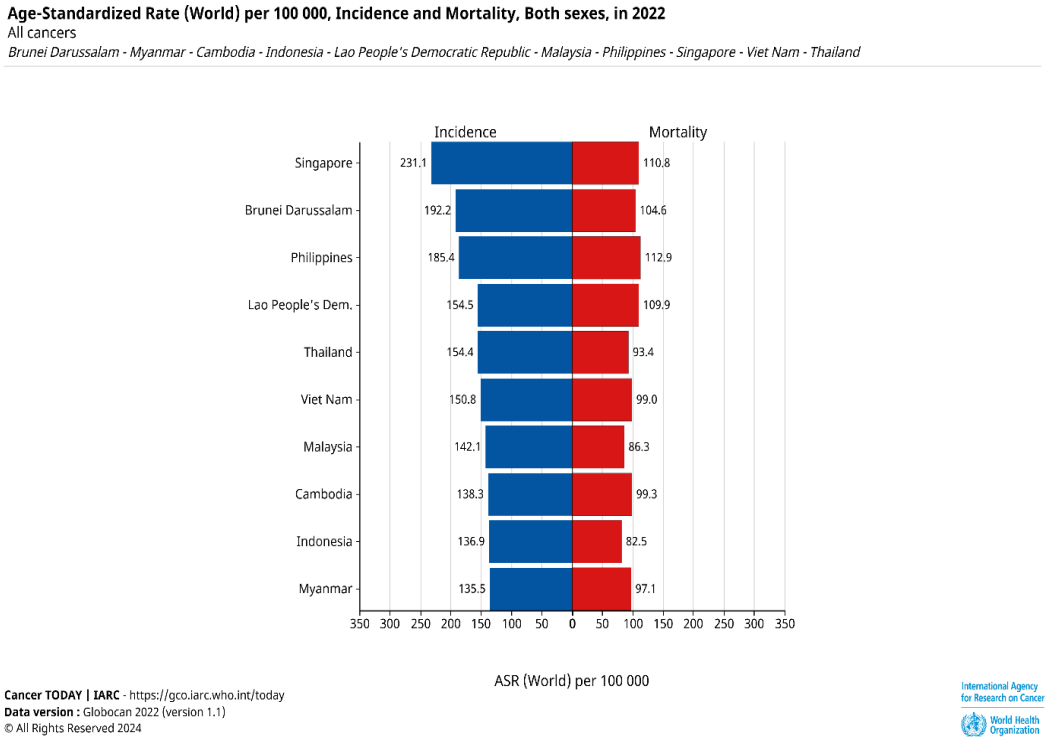

Figure 4. ASMR and ASIR Country Per 100.000; source: Global Cancer Obsercatory (IARC), 2022

genetic, environmental, and lifestyle factors that may explain the high ASIR and ASMR rates for breast cancer in Brunei [13–16].

It has been reported that approximately 91.7% of adults in Brunei do not meet the World Health Organization's recommended intake of fruits and vegetables, and around 25% of Bruneians are not physically active enough, with women being notably more likely to be inactive than men [12]. Despite adoption of significant tobacco control measures, smoking prevalence has been found to be relatively high among men in Brunei Darussalam, with reports of tobacco brought in illegally. Almost one fifth of the adult population in Brunei Darussalam were reported being current smokers, where males were close to ten times more likely to smoke than females [12].

Brunei Darussalam has implemented several cost effective tobacco control measures to curb tobacco use, such as increasing tobacco taxation, banning of advertisement or sponsorship, strengthening enforcement of smoke-free zones and expanding smokefree zones, addressing illicit tobacco trade, and conducting mass media campaigns and education activities to prevent initiation of smoking and encourage smokers to quit [17].

Cambodia

Cambodia shows an ASIR value of 138.3 and an ASMR value of 99.3. When looking at the top five highest ASIR and ASMR values for cancer diseases in Cambodia, breast cancer and cervical cancer both show the same and highest values at 25.1, while prostate cancer has the smallest ASIR value at 12.6. Cambodia's first dedicated multidisciplinary cancer center, the National Cancer Centre (NCC), opened on January 15, 2018, in Phnom Penh at Calmette Hospital. As a public hospital, the NCC is supported by the Cambodian government, the French government, and the International Atomic Energy Agency (IAEA) [18].

In Cambodia, with a female population of 8.2 million, cervical cancer ranks as the second most common cancer among women, after breast cancer. The age-standardized incidence rate(13.5 per 100,000 women) and mortality rate (10.1 per 100,000 women) for cervical cancer are significantly higher than both regional and global averages [19]. Recognizing the urgent need for intervention, cervical cancer was prioritized in the National Strategy for the Prevention and Control of Non-communicable Diseases (NCDs) for the period 2007-2010 [20]. Participation reached its highest point in the third year (2016) with nearly 60,000 women, and the number of women suspected of having cancer peaked in the fourth year (2017) at 1,154, nearing the previously mentioned estimated incidence rate of cervical cancer [19]. In 2008, the Cambodian Ministry of Health (MOH) introduced a national guideline for cervical cancer screening, using visual inspection with acetic acid (VIA) and immediate cryotherapy treatment (referred to as the "screen and treat" approach) as the nationwide strategy. This was later followed by the national strategic plan for Non-communicable Diseases (NCDs) for the period 2013-2020 [18].

Indonesia

Indonesia recorded an Age-standardized incidence rate(ASIR) of 136.9 and an Age-standardized mortality rate (ASMR) of 82.5, with a 5-year prevalence that is relatively high compared to other ASEAN countries, reaching 1,018,110 cases. According to Table 3, breast cancer has the highest ASIR, at 41.8, followed by cervical

cancer at 23.3. Cancer mortality profiles in Indonesia indicate that the most frequently diagnosed new cancers are breast cancer (43.3%), followed by prostate cancer (30.7%), and lung cancer (23.1%). Data from the Basic Health Research (Riskesdas) show an increase in cancer prevalence in Indonesia, rising from 1.4% in 2013 to 1.49% in 2018 [21].

The occurrence of cancer in women needs to be taken seriously. In a study conducted at a hospital in Indonesia, cancers were the most common types affecting females, namely breast cancer (1,010 cases [15.6%]), cervical cancer (629 cases [9.1%]), and ovarian cancer (495 cases [6.8%]) [22]. Almost half of the breast cancer (BC) patients in our setting experienced a delay in presentation, and 64.7% faced a delay in diagnosis. These delays increased the likelihood of patients presenting with a more advanced stage of the disease. Further research is needed in Indonesia to explore the feasibility of evidence-based approaches to reducing delays at both levels, including educational interventions to raise awareness of breast cancer symptoms and simplifying the currently complex and convoluted referral pathways for patients suspected of having cancer [23].

Another cause of cancer is smoking. The smoking rate among Indonesian males is the highest in ASEAN countries [24]. Among all cancers, lung cancer is the leading cause of death. Based on ASIR data from Table 3, lung cancer ranks third in the highest ASIR rates and accounts for 80% of all cancer deaths attributable to smoking. Thus, one-third of all cancer-related deaths are caused by smoking. Moreover, in 2013, the burden of premature death due to smoking was 95% in males and 5% in females in Indonesia [7]. In September 2015, Indonesia was one of 193 countries that signed the commitment to achieve the Sustainable Development Goals (SDGs). However, to this day, Indonesia remains the only ASEAN country that has not ratified the Framework Convention on Tobacco Control (FCTC) [25].

Laos

The country of Laos recorded an ASIR value of 154.5 and an ASMR value of 109.9. The ASMR value for males was 132.9 and for females was 109.9, showing an increase from the findings of a study conducted by Lua et al. [26]. In that study, it was stated that the cancer mortality rates of all sites (ASMR) were 116.7 and 97.2 per 100,000 in males and females, respectively. Breast cancer had the highest ASIR value at 31.6, followed by liver cancer at 24.9. According to data from Globocan, the top three leading cancers in Laos are liver cancer, breast cancer, and lung cancer. Liver cancer accounted for 15.2% of all cancer cases, while breast cancer accounted for 11.4% [27]. Liver cancer was the leading cause of cancer-related deaths in Laos. The occurrence of liver cancer in the country might be linked to the high prevalence of HBV and HCV. Specifically, we found that 8,498 study subjects were HBsAg(+) with a prevalence rate of 8.6%, and 860 were HCV(+) with a prevalence rate of 2.6%. A mass HBV vaccination program for newborns and children would be a high priority in Laos at present [26].

Table 3. 2022 South East Asian Countries: Cancer Sites By Country

Country																					
Brunei Darussalam		Cambodia		Indonesia		Laos		Malaysia		Myanmar		Philippines		Singapore		Thailand		Vietnam	
Cancer site	ASIR	Cancer site	ASIR	Cancer site	ASIR	Cancer site	ASIR	Cancer site	ASIR	Cancer site	ASIR	Cancer site	ASIR	Cancer site	ASIR	Cancer site	ASIR	Cancer site	ASIR
Breast	41.5	Breast	25.1	Breast	41.8	Breast	31.6	Breast	46.1	Breast	23.4	Breast	60.3	Breast	72.6	Breast	37.4	Breast	38.0
Cervix uteri	21.6	Liver	25.1	Cervix uteri	23.3	Liver	24.9	Colorectum	19.7	Cervix uteri	21.4	Prostate	24.1	Colorectum	34.0	Liver	22.7	Lung	20.3
Lung	13.7	Lung	15.7	Lung	13.4	Lung	17.6	Lung	15.1	Lung	16.1	Lung	24.0	Prostate	32.8	Lung	18.1	Liver	20.2
Colorectum	12.9	Cervix uteri	15.2	Colorectum	12.1	Colorectum	14.1	Prostate	12.9	Stomach	11.8	Colorectum	20.8	Lung	24.3	Colorectum	15.9	Colorectum	13.9
Prostate	10.7	Colorectum	12.6	Prostate	10.5	Cervix uteri	12.0	Cervix uteri	10.3	Liver	10.7	Cervix uteri	15.5	Corpus uteri	17.6	Cervix uteri	14.9	Stomach	13.4

ASIR, age-standardised incidence rate

Malaysia

Malaysia recorded an ASIR value of 142.1 and an ASMR value of 86.3. According to Table 3, breast cancer had the highest ASIR value at 46.1, followed by colon cancer at 19.7. A study conducted in Malaysia found that physical inactivity only increased the risk of two types of cancer, namely colorectal and breast cancer [28]. The second largest risk factor for cancer in Malaysia is excess weight. The possible reason is the high prevalence of overweight and obesity among the Malaysian population. The prevalence of overweight and obesity among adults (aged 18 and above) has increased drastically over the years, from 16.6% and 4.4% in 1996 to 30.0% and 17.7% in 2015, respectively [29].

The cancer trend in Malaysia is clearly noticeable, with breast cancer (BC) and colorectal cancer (CRC) being the most prevalent types. A major concern is that nearly half of BC cases and over 60% of CRC cases are diagnosed at advanced stages, specifically Stages III and IV [30] and about half of cancer-related deaths in Malaysia could be avoided if cancer was detected and diagnosed early [31]. The breast cancer (BC) screening program advises that all women aged 35 and above in the general population be offered a Clinical Breast Examination (CBE). Additionally, women between the ages of 50 and 74 are recommended to undergo a mammogram every two years [32]. Meanwhile, Malaysia's colorectal cancer (CRC) screening guidelines suggest that primary care clinicians perform opportunistic screening using an immunochemical fecal occult blood test (iFOBT) for individuals aged 50–74 who have no family history of CRC and show no symptoms [33].

Myanmar

Myanmar reported an ASIR of 135.5 and an ASMR of 97.1. As shown in Table 3, breast cancer had the highest ASIR at 23.4, followed by cervical cancer at 21.4. Non-communicable diseases (NCDs) were estimated to be responsible for 68% of all deaths in Myanmar, with cancer contributing to 13% of NCD-related deaths in 2016 [34]. Previous research shows, the age-standardized incidence rates (World) were 141.9 for men and 123.7 for women. The female data in this study were higher, reporting 129.8, while the male data were lower compared to this study's findings, which showed 135.5 for men. In terms of mortality, the five leading causes of cancer-related deaths are lung cancer, cervical cancer, stomach cancer, breast cancer, and liver cancer [35] these findings align with the results of this study, in which breast cancer and cervical cancer showed the highest ASIR values.

This is consistent with previous research, which found that cervical cancer ranked seventh among the most common cancers in both sexes combined and second in females after breast cancer, with an ASIR of 14.1 and a cumulative risk of 1.64. Regarding mortality, it is the eighth leading cause of cancer deaths in both sexes combined and the fourth leading cause in females. In 2020, the Ministry of Health of Myanmar, with support from Gavi (the Vaccine Alliance), launched the HPV immunization program and began vaccinating girls aged 9 to 10 years in the country [36]. Thus, the future generation of girls will be protected from HPV attributable cancers, including cervical cancer in Myanmar.

This is consistent with previous research, which found that cervical cancer ranked seventh among the most common cancers in both sexes combined and second in females after breast cancer, with an ASIR of 14.1 and a cumulative risk of 1.64. Regarding mortality, it is the eighth leading cause of cancer deaths in both sexes combined and the fourth leading cause in females. In 2020, the Ministry of Health of Myanmar, with support from Gavi (the Vaccine Alliance), launched the HPV immunization program and began vaccinating girls aged 9 to 10 years in the country [36]. Thus, the future generation of girls will be protected from HPV attributable cancers, including cervical cancer in Myanmar.

Philippines

Phillippines shows an ASIR value of 185.4 and an ASMR value of 112.9. Referring to Table 3, breast cancer has the highest ASIR value at 60.3, followed by prostate cancer at 24.1. The ASIR value for breast cancer in the Philippines is the highest among all countries for this type of cancer. Breast cancer is the most common type of cancer among women.The Philippines is a large lower middle-income country (LMIC) in Southeast Asia, covering 300,000 sq km with a population of 110 million. Cancer ranks as the fourth leading cause of death, with nearly 49,000 cancer-related deaths in 2021 alone [37]. One of the challenges in addressing cancer is the geographic disparities in health resources, particularly the medical workforce, which are evident across the archipelago of more than 7,600 islands. Six out of ten Filipinos die without ever receiving an examination from a doctor [38].

The latest report from the Philippine Cancer Society indicated that in 2015, there were 20,267 newly diagnosed breast cancer cases, accounting for 33% of all cancer cases. Even more concerning, an estimated 7,384 deaths due to breast cancer occurred that same year, making it the third leading cause of cancer-related mortality [39]. Similarly, a Global Cancer Report analyzing data from 15 Asian countries found that the Philippines has the highest breast cancer mortality rate and the lowest mortality-to-incidence ratio. In Asia, the highest breast cancer incidence rates among women are observed in Taiwan, Singapore, and the Philippines. Meanwhile, China and India share the same incidence rate of 19 cases per 100,000 women, with an estimated 126,000 new cases annually in China and 83,000 in India [40].

Singapore

Singapore has an ASIR value of 231.1, the highest among ASEAN countries. Additionally, Singapore has an ASMR value of 110.8. Referring to Table 3, breast cancer has the highest ASIR value at 72.6, followed by colorectal cancer at 34.0. The ASIR value for breast cancer is the highest compared to other countries.

Breast cancer is the leading type of cancer in women, making up 25% of all cancer cases in females worldwide [41]. Notably, the incidence of breast cancer in Asia is increasing at a faster rate compared to Western countries

[42]. Singapore reported an annual increase of 3.9%, while the United States saw a 1.5% increase [43]. The modifiable risk factor, BMI, has the potential to reduce up to 16.2% of all breast cancer cases in Singapore if all women with high BMI in the population were to attain a BMI of <25 kg/m2. High breast density, a strong risk factor for breast cancer, and ethnicity had PAR of close to 50% for breast cancer in Singapore [44]. This is in line with results from Western populations that, among the well-known risk factors for breast cancer, it is highly attributable to high breast density. The association between breast density and breast cancer is well-established and has been confirmed by many studies since it was first described by Wolfe in 1976 [45, 46].

The second highest ASIR in Singapore is for colorectal cancer. A separate study in Singapore, part of a continuing cohort analysis of 61,321 Chinese men and women, found that a higher CDAI, which aggregates major food-based antioxidants, was associated with a reduced risk of developing colorectal cancer [47].

Thailand

Thailand reports an ASIR value of 154.4 and an ASMR value of 93.4. According to Table 3, breast cancer has the highest ASIR value at 37.4, followed by prostate cancer at 22.7. The country's rapid socioeconomic growth and changes in mortality have resulted in cancer becoming the top cause of premature death. With a population of nearly 65 million, it was estimated that Thailand saw around 170,500 new cancer diagnoses and 114,200 cancer deaths in 2018 [48], with lung, liver and colorectum the most common cancers among men, and breast, cervix and lung the most frequent cancers in women. According to the research conducted by Sangrajrang et al. [49], breast cancer accounted for nearly three out of ten cancers in women (29.4%), while colorectal and cervical cancers followed as the second and third most common, with 10.0% and 8.5% of female cases, respectively. Lung cancer (7.9%) and ovarian cancer (5.2%) ranked fourth and fifth. The rise in breast cancer cases is associated with economic development and the adoption of a more westernized lifestyle, including shifts in key reproductive risk factors such as delayed childbirth and fewer children. Currently, limited resources prevent the implementation of national mammographic screening, but Thailand launched a national clinical breast examination program in 2014, although the results remain inconclusive so far.

Liver cancer is the second most common cancer among men in Bangkok. Of the average 1,100 cases diagnosed annually between 2011 and 2015, the majority are hepatocellular carcinoma (HCC), rather than cholangiocarcinoma, which is the dominant subtype in northeast Thailand, where liver fluke infections remain prevalent. Thailand's Expanded Program on Immunization (EPI) introduced the Hepatitis B vaccination for newborns in 1988, initially in two provinces, and expanded the program nationwide by 1992, with nearly 100% coverage today. A recent study in Thailand has shown a decline in the rates of Hepatitis B surface antigen (HBsAg) carriers and natural HBV infections among those born after the vaccine was incorporated into the EPI program [50], the longer-term expectation is a reduction in the incidence rate of HBV-associated diseases, including HCC (Hepatocellular carcinoma).

Vietnam

Vietnam reports an ASIR of 150.8 and an ASMR of 99.0. According to Table 3, breast cancer has the highest ASIR at 38.8, followed by prostate cancer at 20.3. Besides tobacco use, alcohol consumption among Vietnamese adults could also be a contributing factor to cancer trends. The Global Status Report on Alcohol 2004 states that alcohol consumption per Vietnamese adult rose by about 2.5 times between 1993 and 2000 [51]. Furthermore, a mental health study conducted in 2000 found that 5.5% of Vietnamese adults were impacted by alcohol abuse [52]. Excessive alcohol consumption is linked to a higher risk of developing cancers of the lung, larynx, esophagus, bladder, pancreas, and kidneys [53]. Alcohol consumption was the third most significant risk factor for cancer in Vietnam, contributing to 6% of cancer cases in our analysis. Like tobacco smoking, most alcohol-related cancers (95.2%) occurred in men [54].

Syntesis

Data shows that in most countries, breast cancer has the highest ASIR value among all types of cancer. Each nation has implemented specific initiatives that can serve as examples and be studied by other member states. Brunei Darussalam has implemented tobacco control policies, Cambodia has introduced a national cervical cancer screening program, and Thailand has launched a clinical breast examination initiative. These efforts highlight the importance of cooperation at both national and regional levels in cancer prevention. Brunei Darussalam's tobacco control policies have contributed to a lower cancer-related mortality rate compared to other countries. Meanwhile, Cambodia and Thailand have implemented cancer screening initiatives; however, their ASIR (Age-Standardized Incidence Rate) remains relatively high. This is due to factors such as obesity, alcohol consumption traditions, smoking and lifestyle choices [49]. Secondhand smoke remains a significant global health issue, as it is a well-known risk factor for various cancers. The ASEAN region faces a heavy cancer burden due to the high prevalence of secondhand smoke. Among different types of cancers, lung cancer shows the highest incidence and mortality rates linked to secondhand smoking. Additionally, the number of cancer cases and deaths attributed to secondhand smoke varies across ASEAN countries, influenced by differences in population size, the underlying risk of cancer, and the prevalence of secondhand smoking in each nation. Overall, secondhand smoke accounts for approximately two-fifths of cancer incidence and mortality in the ASEAN region [55].

The challenges in oncology care, such as a shortage of specialized cancer medical professionals, limited access to screening and early detection programs, restricted availability of treatment, and low adherence to treatment, have resulted in many cancer patients in the ASEAN region not receiving timely care [55]. This has also led to an increased burden of disease, such as lost

economic and social opportunities. The rising costs of cancer treatment, coupled with limited financial coverage from social safety nets like government-subsidized health insurance, have made healthcare services inaccessible to a large portion of the population in the ASEAN region [5, 56]. South East Asia is one of the world's largest tobacco epidemic regions [57]. Based on (7) A study utilizing data from GLOBOCAN 2012 estimated that tobacco smoking contributed to approximately 131,502 cancer cases (28.4%) and 105,830 cancer-related deaths (30.5%) in ASEAN in 2012. These findings reinforce prior research emphasizing the necessity of strategic policies to mitigate and prevent the cancer burden in ASEAN and other low- and middle-income countries (LMICs) [8]. A similar trend is also observed in age-standardized mortality rates (ASMR) and age-standardized incidence rates (ASIR) for lung cancer, where males have higher rates than females both overall and in each ASEAN country.

According to GLOBOCAN 2022 data, Europe has the highest cancer incidence and mortality rates, with an ASIR of 265.7 and an ASMR of 106.3 per 100,000 population. North America shows a high incidence rate of 189.2 but a lower mortality rate of 83.9 per 100,000, reflecting better cancer treatment outcomes. Asia has a lower incidence rate of 117.6; however, its mortality rate remains relatively high at 88.0 per 100,000, indicating challenges in early detection and access to care [58] .

Lastly, it is important to note some limitations of this study. The limitations stem from the dataset available in GCO. As explained in the methods section, the data sources are secondary data derived from other sources rather than direct data from the countries studied. As a result, inaccurate reporting, coding errors, and low screening rates are highly likely to occur.

In conclusion, The data across ASEAN countries reveals notable differences in cancer incidence (ASIR) and mortality (ASMR) rates, shaped by various factors including lifestyle choices, socioeconomic status, healthcare systems, and genetic factors. Key risk factors such as tobacco and alcohol consumption, obesity, lack of physical activity, and unhealthy diets are major contributors to the elevated cancer rates in the region. For instance, Singapore and the Philippines report the highest ASIR values for breast cancer, while liver cancer is more common in Laos and Thailand, often associated with liver fluke infections or hepatitis.

While challenges persist, many countries have made strides in cancer control. Brunei Darussalam has implemented tobacco control measures, Cambodia has introduced a national cervical cancer screening program, and Thailand has launched a clinical breast examination initiative. These actions highlight the importance of both national and regional cooperation in cancer prevention. However, unequal access to healthcare, especially in rural and remote areas, continues to be a significant issue. To address this, there is a need for continued efforts to enhance early detection, increase public awareness, and improve healthcare access. Developing cancer control strategies tailored to each country's unique cancer profiles and risk factors, alongside regional collaboration, could significantly improve outcomes and alleviate the cancer burden in ASEAN countries.

Author Contribution Statement

: Susi Ari Kristina: Data Analysis and "Corresponding author". Kadek Ida Krisnadewi and Muhammad Daffa Aryasatya : Drafting of manuscript. Anietta Ramadhani and Antokalina Sari Verdiana : Data gathering.

Acknowledgements

General

The authors would like to express their sincere gratitude to all individuals and institutions who supported this study. Special thanks to the Global Cancer Observatory (GCO) for providing access to the cancer data used in this research. We also acknowledge the constructive feedback from reviewers, which significantly improved the quality of this manuscript.

Conflict of Interest

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

References

1. Bray F, Laversanne M, Weiderpass E, Soerjomataram I. The ever-increasing importance of cancer as a leading cause of premature death worldwide. Cancer. 2021;127(16):3029–30. https://doi.org/10.1002/cncr.33587
2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021;71(3):209–49. https://doi.org/10.3322/caac.21660
3. Singh M. Most of the world's cancer cases are now in developing countries. NPR. 2015
4. ASEAN Main Portal [Internet]. 2024 [cited 2024 Dec 15]. ASEAN Secretariat. Available from: https://asean.org/member-states/
5. Kimman M, Norman R, Jan S, Kingston D, Woodward M. The burden of cancer in member countries of the Association of Southeast Asian Nations (ASEAN). Asian Pac J Cancer Prev. 2012;13(2):411–20. https://doi.org/10.7314/apjcp.2012.13.2.411
6. The ACTION Study Group. Catastrophic health expenditure and 12-month mortality associated with cancer in Southeast Asia: results from a longitudinal study in eight countries. BMC Med. 2015;13(1):190. https://doi.org/10.1186/s12916-015-0433-1
7. Kristina SA, Endarti D, Thavorncharoensap M. Burden of cancer attributable to tobacco smoking in member countries of the Association of Southeast Asian Nations (ASEAN), 2012. Cancer Epidemiol. 2016;44:84–90. https://doi.org/10.1016/j.canep.2016.08.005
8. Kristina SA, Permitasari NPAL, Krisnadewi KI, Santoso KA, Puspawati PR, Masrida WO, et al. Cancer Attributable to Tobacco Smoking in Member Countries of Association of Southeast Asian Nations (ASEAN) in Year 2018. Asian Pac J Cancer Prev. 2019;20(10):2909–15. https://doi.org/10.31557/APJCP.2019.20.10.2909
9. Kristina SA, Permitasari NPAL, Krisnadewi KI, Santosa KA. Incidence and Mortality of Cancers Related to Secondhand Smoking in Southeast Asia Countries. Asian Pac J

Cancer Prev. 2019;20(3):971–6. https://doi.org/10.31557/APJCP.2019.20.3.971
10. Jain U, Rahim F, Jain B, Komanduri A, Arkalgud A, Sabet CJ, et al. Cancer burden across the South Asian Association for Regional Cooperation in 2022. BMJ Oncol. 2024;3(1):e000466. https://doi.org/10.1136/bmjonc-2024-000466.
11. Qin Y, Tong X, Fan J, Liu Z, Zhao R, Zhang T, et al. Global Burden and Trends in Incidence, Mortality, and Disability of Stomach Cancer From 1990 to 2017. Clin Transl Gastroenterol. 2021;12(10):e00406. https://doi.org/10.14309/ctg.0000000000000406
12. Ong SK, Lai DTC, Wong JYY, Si-Ramlee KA, Razak LA, Kassim N, et al. Cross-sectional STEPwise Approach to Surveillance (STEPS) Population Survey of Noncommunicable Diseases (NCDs) and Risk Factors in Brunei Darussalam 2016. Asia Pac J Public Health. 2017 Nov;29(8):635–48. https://doi.org/10.1177/1010539517738072
13. Arnold M, Morgan E, Rumgay H, Mafra A, Singh D, Laversanne M, et al. Current and future burden of breast cancer: Global statistics for 2020 and 2040. Breast. 2022;66:15-23. https://doi.org/10.1016/j.breast.2022.08.010
14. Hayes J, Richardson A, Frampton C. Population attributable risks for modifiable lifestyle factors and breast cancer in New Zealand women. Intern Med J. 2013;43(11):1198–204. https://doi.org/10.1111/imj.12256
15. Li N, Deng Y, Zhou L, Tian T, Yang S, Wu Y, et al. Global burden of breast cancer and attributable risk factors in 195 countries and territories, from 1990 to 2017: results from the Global Burden of Disease Study 2017. J Hematol OncolJ Hematol Oncol. 2019;12(1):140. https://doi.org/10.1186/s13045-019-0828-0
16. Momenimovahed Z, Salehiniya H. Epidemiological characteristics of and risk factors for breast cancer in the world. Breast Cancer Targets Ther. 2019;11:151–64. https://doi.org/10.2147/BCTT.S176070
17. Ministry of Health. Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases (BruMAP-NCD) 2021–2025. 2021. 2023 [cited 2024 Dec 15]. Ministry of Health. Brunei Darussalam. Available from: https:// www. moh. gov. bn/ Shared% 20Doc uments/ BRUMAP% 20EXEC% 20Sum mary% 202021. pdf
18. Gardner J, Eav S, Rath B, Bunpa P, Mel M, Ath V, et al. Advancing Cancer Care Infrastructure in Cambodia: Summary of the First 100 Patients with Cervical Cancer Treated at the National Cancer Centre. Asian Pac J Cancer Biol. 2024;9(3):287–93. https://doi.org/10.31557/APJCB.2024.9.3.287
19. Ferlay J, Ervik M, Lam F, C. Global Cancer Observatory: Cancer Today. Lyon, France: International Agency for Research on Cancer. 2018 [Internet]. 2021. Available from: https://gco.iarc.fr/today/data/factsheets/populations/116-cambodia-fact- sheets.pdf
20. Kanal K, Fujita N, Soeung SC, Sim KL, Matsumoto Y, Haruyama R, et al. The cooperation between professional societies contributes to the capacity building and system development for prevention and control of cancer in low- and middle-income countries: the practice of Cervical Cancer Prevention and Control Project in Cambodia. Glob Health Med. 2020;2(1):48–52. https://doi.org/10.35772/ghm.2020.01000
21. Infodatin. Beban Kanker Di Indonesia Beban Kanker Global Dunia saat ini menghadapi - Studocu [Internet]. Kementrian Kesehatan Indonesia; 2019 [cited 2025 Jan 30]. Available from: https://www.studocu.id/id/document/universitas-udayana/antropologi-kesehatan/infodatin-kanker-2019/32696320
22. Prihantono, Rusli R, Christeven R, Faruk M. Cancer incidence and mortality in a tertiary hospital in indonesia: An 18-year data review. Ethiop J Health Sci. 2023;33(3):515-22. https://doi.org/10.4314/ejhs.v33i3.15.
23. Hutajulu SH, Prabandari YS, Bintoro BS, Wiranata JA, Widiastuti M, Suryani ND, et al. Delays in the presentation and diagnosis of women with breast cancer in Yogyakarta, Indonesia: A retrospective observational study. PloS One. 2022;17(1):e0262468. https://doi.org/10.1371/journal.pone.0262468.
24. Southeast Asia Tobacco Control Alliance (SEATCA). ASEAN tobacco control atlas. [Internet]. 2014 [cited 2025 Jan 30]. Available from: https://seatca.org/dmdocuments/2nd%20Edition_The%20ASEAN%20Tobacco%20Control%20Atlas_Final%20Version.pdf
25.Center for Indonesia's Strategic Development Initiatives (CISDI). Policy Paper Pengendalian Tembakau Dalam Konteks Sustainable Development Goals: Menuju Generasi Muda Yang Berkualitas. Policy Paper; 2016.
26. Lua NT, Chinh ND, Hue NT, Van VTT, Hang TM, Linh LT, et al. Survey-based Cancer Mortality in the Lao PDR, 2007-08. Asian Pac J Cancer Prev. 2011;12(10):2495-8.
27.Global Cancer Observatory. Laos people's Democratic Republic [Internet]. World Health Organization; 2022. Available from: https://gco.iarc.who.int/media/globocan/factsheets/populations/418-lao-peoples-democratic-republic-fact-sheet.pdf
28. Teh HS, Woon YL. Burden of cancers attributable to modifiable risk factors in Malaysia. BMC Public Health. 2021;21(1):410. https://doi.org/10.1186/s12889-021-10412-9
29. Ministry of Health Malaysia. National Health and Morbidity Survey [Internet]. Ministry of Health Malaysia; 2015. Available from: https://www.moh.gov.my/moh/resources/nhmsreport2015vol2.pdf
30. Muhammad Nawawi KN, Mokhtar NM, Wong Z, Mohd Azman ZA, Hsin Chew DC, Rehir R, et al. Incidence and clinicopathological features of colorectal cancer among multi-ethnic patients in Kuala Lumpur, Malaysia: a hospital-based retrospective analysis over two decades. PeerJ. 2021;9:e12425. https://doi.org/10.7717/peerj.12425
31. Ho GF, Taib NA, Singh RKP, Yip CH, Abdullah MM, Lim TO. What If All Patients with Breast Cancer in Malaysia Have Access to the Best Available Care: How Many Deaths Are Avoidable? Glob J Health Sci. 2017;9(8):p32. https://doi.org/10.5539/gjhs.v9n8p32
32. Ministry of Health Malaysia, Academy of Medicine Malaysia. Management of Cancer (Third edition) [Internet]. Ministry of Health Malaysia; 2019. Available from: https://mymahtas2.moh.gov.my/files/CPG_Management_of_Breast_Cancer_(Third_Edition)_.pdf
33. Ministry of Health Malaysia. National Strategic Plan For Colorectal Cancer (NSPCRC) 2021-2025 [Internet]. Ministry of Health Malaysia; 2021. Available from: https://www.moh.gov.my/moh/resources/Penerbitan/Rujukan/NCD/Kanser/National_Strategic_Plan_for_Colorectal_Cancer_(NSPCRC)_2021-2025.pdf
34. Shwe K, Win S, Thant A, Htay AM, Han H, Paw NH. Cancer Incidence and Mortality in Central Myanmar: Report of Nay Pyi Taw Population-Based Cancer Registry. Asian Pac J Cancer Prev. 2022;23(1):311–8. https://doi.org/10.31557/APJCP.2022.23.1.311
35. Ferlay. CancerGlobal Cancer Observatory: Cancer Today Today [Internet]. 2020 [cited 2025 Feb 2]. Available from: https://gco.iarc.who.int/today/
36. Bruni L, Albero G, Serrano B, Mena M, Collado JJ, Gómez

D, et al. Human Papillomavirus and Related Diseases Report, Myanmar [Internet]. 2023 [cited 2025 Feb 2]. Available from: https://hpvcentre.net/statistics/reports/MMR.pdf
37. Philippine Statistics Authority. Causes of Deaths in the Philippines (Preliminary): January to October 2021 | Philippine Statistics Authority | Republic of the Philippines [Internet]. 2021 [cited 2025 Jan 30]. Available from: https://psa.gov.ph/content/causes-deaths-philippines-preliminary-january-october-2021
38. World Health Organization. Universal health care: the best investment the Philippines will make [Internet]. 2019 [cited 2025 Jan 30]. Available from: https://www.who.int/philippines/news/commentaries/detail/universal-health-care-the-best-investment-the-philippines-will-make
39. Philippine Cancer Society. Philippine Cancer Fact and Estimates [Internet]. Manila Regestry Departement of Health; 2015 [cited 2025 Jan 31]. Available from: http://thepafp.org/wp-content/uploads/2017/05/2015-PCS-Ca-Facts-Estimates_CAN090516.pdf
40.Pzifer. The Burden of Cancer in Asia [Internet]. 2008 [cited 2025 Jan 31]. Available from: https://cdn.pfizer.com/pfizercom/products/cancer_in_asia.pdf
41. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, et al. Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer. 2015;136(5):E359–86. https://doi.org/10.1002/ijc.29210
42. Lim YX, Lim ZL, Ho PJ, Li J. Breast Cancer in Asia: Incidence, Mortality, Early Detection, Mammography Programs, and Risk-Based Screening Initiatives. Cancers. 2022;14(17):4218. https://doi.org/10.3390/cancers14174218
43. Jara-Lazaro AR, Thilagaratnam S, Tan PH. Breast cancer in Singapore: some perspectives. Breast Cancer Tokyo Jpn. 2010;17(1):23–8. https://doi.org/10.1007/s12282-009-0155-3
44. Ho PJ, Lau HSH, Ho WK, Wong FY, Yang Q, Tan KW, et al. Incidence of breast cancer attributable to breast density, modifiable and non-modifiable breast cancer risk factors in Singapore. Sci Rep. 2020;10(1):503. https://doi.org/10.1038/s41598-019-57341-7
45. Peres J. Understanding breast density and breast cancer risk. J Natl Cancer Inst. 2012;104(18):1345–6. https://doi.org/10.1093/jnci/djs403
46. Wolfe JN. Breast patterns as an index of risk for developing breast cancer. AJR Am J Roentgenol. 1976;126(6):1130–7. https://doi.org/10.2214/ajr.126.6.1130
47. Yu YC, Paragomi P, Wang R, Jin A, Schoen RE, Sheng LT, et al. Composite dietary antioxidant index and the risk of colorectal cancer: Findings from the Singapore Chinese Health Study. Int J Cancer. 2022;150(10):1599–608. https://doi.org/10.1002/ijc.33925
48. Ferlay J, Colombet M, Soerjomataram I, Mathers C, Parkin DM, Piñeros M, et al. Estimating the global cancer incidence and mortality in 2018: GLOBOCAN sources and methods. Int J Cancer. 2019;144(8):1941–53. https://doi.org/10.1002/ijc.31937
49. Sangrajrang S, Laversanne M, Bausom R, Mery L, Bray F. Cancer incidence and cancer control in Bangkok, Thailand: Results from the cancer registry 2011-15 and projections to 2035. Cancer Epidemiol. 2020;67:101765. https://doi.org/10.1016/j.canep.2020.101765
50. Posuwan N, Wanlapakorn N, Sa-Nguanmoo P, Wasitthankasem R, Vichaiwattana P, Klinfueng S, et al. The Success of a Universal Hepatitis B Immunization Program as Part of Thailand's EPI after 22 Years' Implementation. PloS One. 2016;11(3):e0150499. https://doi.org/10.1371/journal.pone.0150499
51. World Health Organization. Global Status Report on Alcohol 2004 [Internet]. 2004 [cited 2025 Jan 31]. Available from: https://www.who.int/publications/i/item/global-status-report-on-alcohol-2004
52. Ministry of Health Vietnam. Social Assessment Report [Internet]. 2018. Available from: https://documents1.worldbank.org/curated/zh/783561550474201301/pdf/Social-Assessment-Final-E.pdf
53. Xie L, Semenciw R, Mery L. Cancer incidence in Canada: trends and projections (1983-2032). Health Promot Chronic Dis Prev Can Res Policy Pract. 2015;35 Suppl 1:2–186.
54. Nguyen TP, Luu HN, Nguyen MVT, Tran MT, Tuong TTV, Tran CTD, et al. Attributable Causes of Cancer in Vietnam. JCO Glob Oncol. 2020;(6):195–204. https://doi.org/10.1200/JGO.19.00239
55. Alberto NRI, Alberto IRI, Puyat CVM, Antonio MAR, Ho FDV, Dee EC, et al. Disparities in access to cancer diagnostics in ASEAN member countries. Lancet Reg Health West Pac. 2023;32:100667. https://doi.org/10.1016/j.lanwpc.2022.100667
56. Jan S, Kimman M, Kingston D, Woodward M. The socioeconomic burden of cancer in member countries of the Association of Southeast Asian Nations (ASEAN)--stakeholder meeting report. Asian Pac J Cancer Prev. 2012;13(2):407–9. https://doi.org/10.7314/apjcp.2012.13.2.407
57. Katanoda K, Jiang Y, Park S, Lim MK, Qiao YL, Inoue M. Tobacco control challenges in East Asia: proposals for change in the world's largest epidemic region. Tob Control. 2014;23(4):359–68. https://doi.org/10.1136/tobaccocontrol-2012-050852
58. International Agency for Research on Cancer. International Agency for Research on Cancer. International Agency for Research on Cancer. 2022. Global Cancer Observatory: Cancer Today. Available from: https://gco.iarc.fr/today