Epidemiology of Cardiovascular Diseases in Southeast Asia: A Systematic Review

Jeffrey Valencia, MD | Namphril Malaluan, MD | Paula Victoria Catherine Cheng, MD | Michael Brian Alvarez, MD | Rody Sy, MD | Felix Eduardo Punzalan, MD
Division of Cardiovascular Medicine, Department of Medicine
Philippine General Hospital
University of the Philippines College of Medicine

Abstract

BACKGROUND: Cardiovascular disease (CVD) is a group of disorders of the heart and blood vessels, which includes coronary heart disease, cerebrovascular disease, and peripheral artery disease. It is currently the leading cause of death worldwide. Currently, there is paucity in the available epidemiologic data of CVD in Southeast Asia (SEA).

OBJECTIVE: To determine the prevalence, mortality rate, and associated risk factors of CVD (specifically ischemic heart disease, stroke, and peripheral artery disease) among adult populations in SEA.

METHODS: A systematic review of published articles between 2015 and 2020 was conducted. The authors also searched the World Health Organization database and publicly available health department websites of Southeast Asian countries.

RESULTS: The overall prevalence of CVDs in SEA is 5.48%. Specifically, the prevalence of ischemic heart disease is 1.54% and is highest in Thailand (2.54%). Ischemic stroke has a prevalence of 1.03% and is highest in Indonesia (1.97%). Prevalence of peripheral artery disease is 1.36% and is also highest in Thailand (1.92%). Mortality rate from CVD in SEA is 13.41%. Hypercholesterolemia, smoking, and hypertension are the most common risk factors, with prevalence of 41.2%, 21.1%, and 20.9%, respectively.

CONCLUSION: The prevalence and mortality rate of CVD in SEA remain high and are associated with high prevalence of underlying risk factors. Interventions should be strengthened to improve the overall picture in the region. Collaborative efforts among Southeast Asian countries are essential not only in generating comparative epidemiologic data but also in sharing best practices in lowering CVD mortality and morbidity.

KEYWORDS: cardiovascular disease, ischemic heart disease, stroke, peripheral artery disease, risk factors, Southeast Asia

BACKGROUND

Southeast Asia (SEA) is composed of 11 countries of impressive diversity in religion, culture, and history: Brunei, Myanmar, Cambodia, Timor-Leste, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. It covers 4,500,000 km^2, which is 10.5% of Asia and 3% of Earth's total land area. The region is the third most populated subregion in the world, with a population of 655,298,044, and is only behind South Asia and East Asia.[1]

Cardiovascular disease (CVD) is now the leading cause of death in the world, with an estimated mortality of 17.9 million each year. Cardiovascular disease is a group of disorders of the heart and blood vessels, which include coronary artery disease, cerebrovascular disease, and peripheral artery disease. It was found that CVD-related risk factors were prevalent in SEA. Consequently, it was among the regions that saw the largest increase in CVD-related mortality in the past 20 years.

The estimated worldwide mortality from CVD in 2016 is 17.9 million, accounting for 31% of all global deaths. Eighty-five percent of these deaths were due to heart attack and stroke.[2] Among CVDs, ischemic heart disease (IHD), also referred to as coronary artery disease or atherosclerotic cardiovascular disease, is the most prevalent worldwide and manifests clinically as myocardial infarction and ischemic cardiomyopathy. An increasing incidence of CVD is seen and is expected to continue due to the rising prevalence of associated diseases and risk factors such as diabetes and obesity. More than 70% of at-risk individuals have multiple risk factors for IHD.[3]

Cerebrovascular disease or stroke is also a major cause of death and disability. In 2013 alone, there were 6.5 million reported deaths from stroke, 113 million disability-adjusted life-years lost, and 25.7 million reported stroke survivors. Currently, Asia has a higher mortality from this disease than Europe and the United States.[4]

Peripheral artery disease is a manifestation of systemic atherosclerosis and is associated with an increased risk of IHD and cerebrovascular disease. The prevalence is higher in diabetic patients.

The data on CVD deaths per 100,000 individuals in 2017 showed differences in curve among countries. In SEA, there is a downward trend from 323 in 1990 to 261 in 2017. Similarly, this trend was also seen in Sub-Saharan Africa and Central Latin America. Central Asia initially showed an increasing trend in CVD death from 1990 to 2005, but a decreasing trend thereafter. Continuous downward trends were seen in Europe and North America.[5]

There is scarcity of data on risk factors of CVD among adults in SEA. The common risk factors include tobacco use, alcohol use, low fruit and vegetable intake, low physical activity, and overweight or obesity.

Most of the published epidemiologic studies on CVD reported mortality rate. However, knowledge about the prevalence of CVDs and its associated risk factors is equally important in formulating health policies that will benefit the population in terms of disease prevention, management, and control. This systematic review aimed to determine the prevalence, mortality rate, and associated risk factors of CVD (specifically ischemic heart disease, stroke, and peripheral artery disease) among adult populations in SEA.

METHODS

Eligibility Criteria

This review adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement for systematic reviews. Eligibility criteria were guided by the PICO (population, intervention comparison, outcome) reporting system, which described the population, exposure or disease, and the specification of the type of study design, from PRISMA.

Study Inclusion

Studies with adult patients 18 years or older with CVDs were included in this study.

Literature Search

The authors performed a systematic computer search of PubMed, Science Direct, Cochrane, and Google Scholar for eligible studies from January 2015 to December 2020. The following search terms in combination were used:

Cardiovascular disease

(1) "cardiovascular diseases" OR "ischemic heart disease" OR "ischemic stroke" OR "peripheral artery disease"

Epidemiology

(2) "epidemiology" OR "prevalence" OR "mortality rate"

Associated risk factors

(3) "cardiovascular risk factors" OR "hypertension" OR "high blood pressure" OR "diabetes mellitus" OR "dyslipidemia" OR "smoking" OR "tobacco use" OR "obesity"

Southeast Asia

(4) "Southeast Asia," "Brunei," "Cambodia," "East Timor," "Indonesia," "Laos," "Malaysia," "Myanmar," "Philippines," "Singapore," "Thailand," "Vietnam"

(5) #1 AND #2 AND #3 AND #4

The authors also searched available database from the World Health Organization (WHO) and publicly accessible national health department websites of the individual countries. References of the retrieved articles were also hand searched for relevant studies. Other data not available through publicly accessible means were obtained by the reviewers through personal communication with Southeast Asian counterparts.

Data Collection and Analysis
Identified studies were evaluated by the authors independently to determine their relevance for full-text retrieval. Data extracted from the articles included information on the publication, the subjects or population involved, and outcomes of interest. Outcome data consisted of prevalence of CVD (focusing on IHD, cerebrovascular disease/stroke, and peripheral artery disease), mortality rate, and its associated risk factors. Data analysis was done descriptively. Primary outcomes were the prevalence of CVDs in SEA, mortality rate, and associated risk factors.

RESULTS

Database Search
We searched the WHO database and collected data on the prevalence of CVDs as well as risk factors of each Southeast Asian country. More recent data on prevalence of and mortality from cardiovascular risk factors were accessed from the Global Burden of Disease—Institute for Health Metrics and Evaluation.[6]

Respective health department websites of each Southeast Asian country were also used as reference for relevant data; however, some countries do not have accessible reports on CVDs. Timor-Leste has no health department website. Cambodia, Laos, and Vietnam had health department websites in their native languages but lacked English translation. Thailand's health agency website did not publish any report on CVDs. More recent data on the prevalence of hypertension were identified for Singapore, Brunei, Malaysia, and Indonesia. Singapore and Malaysia had more recent data on diabetes, whereas Singapore and Brunei had updated data on smoking and hypercholesterolemia.

The researchers also personally inquired with Southeast Asian colleagues for local data. Dr Piyamitr Sritara was able to provide relevant statistics for Thailand (personal communication with Piyamitr Sritara, MD, MD, FRCP, FACP, FRCP, Department of Medicine, Ramathibodi Hospital, Mahidol University, January 26, 2021).

Prevalence of Cardiovascular Diseases
Based on the review of literature, the most extensive and recent data on the prevalence of CVDs were from the database of the Institute for Health Metrics and Evaluation,[6] the source of the Global Heath Estimate Data, which actively collect data, even those unpublished.

Overall, the prevalence of CVD in SEA is 5.48%. Ischemic heart disease has a prevalence of 1.54% overall and is highest in Thailand (2.32%), Malaysia (1.95%), Singapore (1.95%), Philippines (1.68%), and Vietnam (1.62%). The prevalence of ischemic stroke in the region is 1.03% and is highest in Indonesia (1.97%), followed by Thailand (1.65%), Vietnam (1.6%), Malaysia (1.5%), and Brunei (1.29%). The prevalence of peripheral artery disease in the region is 1.36%; it is highest in Thailand (1.92%), Singapore (1.57%), Vietnam (1.42%), Myanmar (1.39%), and Indonesia (1.33%) (Table 1).

Cardiovascular Disease Mortality
The latest 2019 data from the Global Burden of Diseases of the Institute for Health Metrics and Evaluation[6] revealed that 223 of 100,000 deaths in SEA are attributed to CVD. Myanmar has the highest CVD-related mortality rate at 252 per 100,000 and is closely followed by Indonesia and Vietnam at 251 per 100,000 and 249 per 100,000, respectively (Table 2).

Cardiovascular Risk Factors
Hypertension
Based on the WHO data in 2015,[7] the overall prevalence of hypertension in SEA was 20.9%, with Thailand having the highest prevalence at 25%, and was closely followed by

Table 1. Prevalence (in Percent) of Cardiovascular Diseases in Southeast Asia (2019)

Country	IHD	Stroke	PAD
Brunei	0.97	1.29	0.97
Cambodia	1.14	1.07	0.99
East Timor	1.06	1.2	0.86
Indonesia	1.23	1.97	1.33
Laos	0.97	1.16	0.87
Malaysia	1.94	1.5	1.23
Myanmar	1.31	1.09	1.39
Philippines	1.68	1.18	1.03
Singapore	1.95	1.54	1.57
Thailand	2.32	1.65	1.92
Vietnam	1.62	1.6	1.42

IHD=ischemic heart disease; PAD=peripheral artery disease.

Table 2. Mortality Rate From Cardiovascular Diseases in Southeast Asia (2019)

Country	Mortality Rate (Deaths per 100,000)
Brunei	116
Cambodia	182
East Timor	184
Indonesia	251
Laos	188
Malaysia	187
Myanmar	252
Philippines	182
Singapore	120
Thailand	165
Vietnam	249

Table 3. Summary of Cardiovascular Risk Factors Prevalence in Southeast Asia[7]

Country	Hypertension (2015 Data)	Diabetes Mellitus (2014 Data)	Obesity (2018 Data)	Smoking (2018 Data)	Hypercholesterolemia (2008 Data)
Cambodia	23%	6%	4%	21.8%	30.0%
Laos	19%	6%	5%	37.8%	31.4%
Myanmar	23%	7%	6%	45.5%	30.4%
Thailand	25%	10%	11%	22.8%	55.5%
Timor-Leste	21%	4%	3%	38.2%	26.7%
Vietnam	22%	5%	2%	23%	36.1%
Brunei	18% 28% (2017)[9]	9%	15%	15.5%	55.2% 51.3% (2017)[9]
Indonesia	22% 34.11% (2019)[10]	7%	7% 21.8% (2019)[10]	37.9%	35.8%
Malaysia	21%	10% 16.7% (2017)[12]	15%	21.8%	52.1%
Singapore	17% 21.5% (2017)[8]	9%	7%	16.5%	57.5%
Philippines	19% 17.5% (2019)[11]	6% 8.2% (2019)[11]	6% 9.3% (2019)[11]	24.3% 20.3% (2019)[11]	43.4%

Cambodia and Myanmar at 23%, and Indonesia and Vietnam at 22% (Table 3).

More recent data from the Health Population Survey 2017 reported a hypertension prevalence of 21.5% in Singapore.[8] Brunei had a higher prevalence of hypertension at 28%, also reported in 2017.[9]

Health profile data from country-specific health website from Indonesia showed an increased prevalence of hypertension at 34.11% in 2019.[10]

In a personal information with Dr Sritara (personal communication with P. Sritara, January 26, 2021), the trend of hypertension prevalence was increasing from 2013, with the age group older than 60 years having the highest prevalence at 44.07% in 2019.

In the Philippines, data gathered in 2019 from the Food and Nutrition Research Institute (FNRI)[11] showed the prevalence of elevated blood pressure at 17.5%. It was higher among males (17.5%) compared with females (11.1%).

Diabetes
Diabetes mellitus has an average prevalence of 7.18% in SEA. Malaysia and Thailand both have a prevalence of 10%, followed by Brunei with 9%.[7]

More recent data published in 2017 from Malaysia showed an increased prevalence at 16.7%.[12]

Data from Thailand also showed an increasing trend from 2013, with the age group older than 60 years also having the highest prevalence rate at 19.67% in 2019 (personal communication with P. Sritara, January 26, 2021).

In the Philippines, high fasting blood glucose prevalence was noted to be increasing from 3.4% in 2003 to 8.2% in 2019.[11]

Smoking
Average prevalence of smoking in Southeast Asian countries is noted to be high at 21.1%. It is highest in Malaysia at 45.5%, followed by Timor-Leste at 38.2% and Laos at 37.8%.[7]

The same reference showed a glaring difference in the number of smokers between male and female sex. The average prevalence of male smokers was at 38.6%, and that of female smokers was 3.7% (Table 4).

In the Philippines, the 2019 FNRI data showed that 19.9% of adult Filipinos were current smokers during the survey period. Almost half of adult males (41.3%) were smokers, whereas only 5.7% of adult females were smokers.

Obesity
Obesity, defined by the WHO as body mass index of more than 30.0 kg/m^2, is another risk factor for CVD, with an average prevalence of 7.4% in SEA. Prevalence is highest in Brunei and Malaysia, with a prevalence of 15%, followed by Thailand with 11%.[7]

Table 4. Sex Differences Among Smokers in SEA (2016)[7]

Country	Male	Female
Brunei	28.6%	2.5%
Cambodia	37.4%	6.3%
Indonesia	70.5%	5.3%
Laos	60.1%	15.5%
Malaysia	42.7%	1%
Myanmar	70.2%	20.8%
Philippines	41.6%	7%
Singapore	27.8%	5.1%
Thailand	42.5%	3.1%
Timor-Leste	65.8%	10.7%
Vietnam	47%	1%

Latest data from Indonesia in 2019 showed prevalence of obesity at 21.8% (personal communication with P. Sritara, January 26, 2021).

Hypercholesterolemia
Similarly, hypercholesterolemia is highly prevalent in SEA. The average prevalence is 41.2%: 57.50% in Singapore, 55.50% in Brunei and Thailand, 52.10% in Malaysia, and 43.4% in the Philippines.[7]

Based on local data in 2017 from Brunei, 51.3% had either a raised total cholesterol or current medications for raised cholesterol.[9]

DISCUSSION

With the thorough search performed in this systematic review, we have seen that there is paucity of data published regarding the prevalence of CVDs and its risk factors in SEA. Most of the data gathered were obtained from online databases and government health agency websites.

The prevalence of CVDs in SEA is 5.48%, with IHD having a higher prevalence compared with ischemic stroke and peripheral artery disease. The prevalence of IHD among Southeast Asian countries is variable. It was found to be most prevalent in Thailand and least in Brunei. Similarly, Thailand also has the highest prevalence of peripheral artery disease and is second only to Indonesia in the prevalence of ischemic stroke. Ischemic stroke is lowest in Cambodia.

The findings in these data could be attributed to better reporting of epidemiologic data in certain countries in the Southeast Asian region compared with others. Thailand, a country with higher sociodemographic index than Cambodia and Laos (which reported a lower prevalence of CVDs), has a better universal health care; hence, patients have easier access to disease diagnosis and management. This does not, however, necessarily mean that the true prevalence in the less developed countries are reflected in their reported numbers. This puts further emphasis in improving public health systems in order to detect diseases to be able to address them.

Compared with our neighboring countries, the average prevalence of CVDs in SEA (5.48%) is relatively lower than China (8.83%), South Korea (7.36%), and Japan (14.09%). Specifically, IHD is more prevalent in China (3.32%), South Korea (2.46%), and Japan (3.02%) compared with the average prevalence in SEA (1.54%). The same trends are noted in terms of ischemic stroke (SEA 1.03% vs China 1.77%, Japan 2.19%, and South Korea 1.62%) and peripheral artery disease (SEA 1.36% vs China 2.09%, Japan 3.97%, South Korea 1.77%).[6]

The mortality rate from CVDs in SEA (223 per 100,000) is comparable to that of the world average (239 per 100,000). However, comparing it with specific regions, it is lower than that of Central Asia (348 per 100,000), Eastern Europe (761 per 100,000), Central Europe (675 per 100,000), North America (285 per 100,000), and Western Europe (328 per 100,000). Using data from more developed Asian countries in Asia, the cardiovascular mortality in SEA is lower than that in China (322 per 100,000), South Korea (391 per 100,000), and Japan (291 per 100,000).[6] This finding was also observed in a recently published article, which noted that CVD rates were higher in countries of Central and Eastern Asia than in SEA. Ischemic heart disease was the most dominant cause of CVD deaths in Central Asia. Stroke deaths, however, were more common than IHD deaths in Eastern Asia and SEA.[13] This finding is not yet well understood and may be a good focus on further research.

The high prevalence and mortality rate of CVD in SEA are congruent with the persistently high prevalence of associated risk factors. Among these risk factors, hypercholesterolemia has the highest prevalence at 41.2%, smoking at 21.1% with highest percentage in Timor-Leste at 42%, and hypertension at 20.9% and is noted to be highest in Thailand at 25%.

Regarding cardiovascular risk factors, higher prevalence of metabolic risk factors such as hypertension were noted in more developed countries. This could be due to changes in dietary pattern in this region with higher salt consumption and foods rich in cholesterol such as processed foods. On the other hand, smoking was low in Islamic countries where it is prohibited. Further studies that look into the correlation of social, religious, and other behavioral factors are needed in order to understand these trends better.

Looking at the Philippine data, the prevalence of hypertension, defined as blood pressure of greater than or equal to 140/90 mm Hg, has been decreasing in more recent years. The National Nutrition and Health Survey showed hypertension prevalence of 22.5% in 2003, 25.3% in 2008, and 22.3% in 2013.[14–16] The latest data in 2019 showed a prevalence of 17.5% (personal communication with P. Sritara, January 26, 2021). A similar prevalence study conducted by the Philippine Heart Association, the PRESYON study, also showed almost

similar prevalence: 22% in 1998 and 21% in 2007, but an increase at 28% in 2012.[17–19]

In the Philippines, an upward trend in the prevalence of diabetes is observed over the past few years. High fasting blood glucose prevalence was noted to be increasing from 3.4% in 2003 and 4.8% in 2008 to 5.6% in 2013 and further increased to 7.9% in 2018. The LIFECARE (Life Course Study in Cardiovascular Epidemiology) study, a descriptive, prospective cohort study done from 2009 to 2011, also showed a diabetes prevalence of 5%.[20] This could also be attributed to lifestyle changes, which include decrease in physical activity and poor dietary choices.

Prevalence of smoking from the FNRI data showed a downward trend with 34.8% in 2003, 31% in 2008, 25.4% in 2013, 20.7% in 2018, and 19.9% in 2019. To recall, the Sin Tax Law in the Philippines, which imposed higher taxes on cigarettes, was passed in November 2012. It can be surmised that its passage could have helped decrease smoking in the country.

With regard to hypercholesterolemia, data from FNRI showed an increasing trend in prevalence. In 2003, 28.0% of the population was noted to have hypercholesterolemia, and this percentage increased to 31.4% in 2008 and 47.2% in 2013. The LIFECARE study published in 2009–2011 reflects a similar prevalence at 30.67%.

Strengths and limitations

To our knowledge, this is the first systematic review on CVDs in SEA based on intensive search that included computerized search of literature databases, WHO published database, country-specific website search, and personal communication. All the countries in the region were represented in the data analysis regarding prevalence and mortality rate for CVDs.

However, we acknowledge the scarcity of more recent locally published data. We are dependent on available publication of individual country data, and we could have missed some.

Collaborative efforts among Association of Southeast Asian Nations countries are essential not only in generating comparative epidemiologic data but also in sharing best practices in lowering cardiovascular mortality and morbidity.

The data gathered from this review will serve as a guide on policies, programs, and future research. This might also serve as impetus for active publication for different countries with regard to epidemiology.

CONCLUSION

The prevalence and mortality rate of CVD, as well as the prevalence of its associated risk factors, remain to be high in the Southeast Asian region.

There are a lot of interventions available (personal, community, national levels) that may improve further the overall picture in the region.

More systematic reviews such as this study are needed in order to make data-driven health policies both at the national and community levels.

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