A Call for Cohesive Action:
Redefining Cardiovascular Care in the Asia-Pacific

ASIA-PACIFIC
CARDIOVASCULAR DISEASE ALLIANCE

CONTENTS

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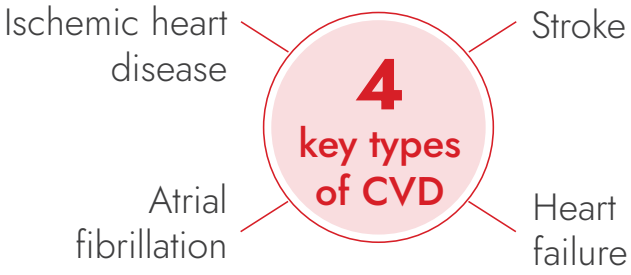
EXECUTIVE SUMMARY

Cardiovascular disease takes 19 lives per minute in the Asia-Pacific. Yet, national CVD strategies – if present –are fragmented and unevenly implemented.

Cardiovascular disease is the Asia-Pacific's number one cause of death.

10+ million

died from CVD in 2019 alone.



Most countries have seen continuous increases in CVD cases and deaths.

From 2009 to 2019, Asia-Pacific countries experience:

10 - 45% increase in IHD and stroke deaths.

20 - 74% rise in atrial fibrillation deaths.

32 million

people estimated to live with **heart failure**

The entire population of Malaysia

$0.7-$49.5 billion

Direct costs of CVD hospitalizations, treatment in 9 Asia-Pacific countries:

*Exceeds **combined** health budgets of Australia, Indonesia, Malaysia and Thailand.*

Indirect costs **are higher** due to lost productivity, absenteeism, family caregiving support.

Everyone is at risk. CVD is especially lethal because it can strike with no symptoms.

Policies must address the entire care continuum of prevention, early detection, treatment and rehabilitation.

But all countries face various CVD policy gaps.

Snapshot of CVD Strategy Evaluation Scorecard for Selected Indicators

Country	CVD-focus of national health policy	Overall score of health promotion and prevention programmes	Overall strength of screening	Overall Strength of Diagnostics	EMS planning for CVD events	Robustness of secondary prevention	Overall management of established CVD	Overall score of system readiness
Australia (AUS)	VH	M	M	VH	H	H	H	VH
Japan (JPN)	VH	M	VH	VH	M	H	M	H
Korea (KOR)	H	M	VH	VH	H	H	H	VH
China (CHN)	M	M	M	H	M	H	M	H
Malaysia (MYS)	M	M	M	M	M	H	M	L
Thailand (THA)	M	H	H	VH	M	VH	H	M
India (IND)	M	L	M	M	VL	M	L	L
Indonesia (IDN)	M	M	H	H	VL	M	L	M
Vietnam (VNM)	M	M	M	M	VL	L	L	L

Very low Low Moderate High Very high

For scoring methodology see page 99

- Most Asia-Pacific countries' national NCD policy addresses CVDs, with efforts focusing on broad risk factor reduction and hypertension control.
- Health promotion and prevention programs inadequately tackle key CVD risk factors - unhealthy eating, diabetis, obesity, hyperlipidaemia, and physical inactivity.
- National screening and diagnostic guidelines are not frequently updated in some countries, while diagnostic capacity is lacking in rural and remote areas.
- Lower- and middle-income Asia-Pacific countries are challenged by poor capacity in emergency and acute care services, little to no step-down care services, and lack of integrated care pathways.
- CVD care capacity is further limited by poor workforce development planning, lack of research and development for CVD care, and ineffective monitoring and evaluation practices for auditing health system performance.

A holistic national strategy for cardiovascular disease (CVD) management is imperative, encompassing collaborative efforts led by health ministries, integrated health systems focusing on prevention, primary care, tertiary care, and rehabilitation.

What every country needs:

1. A ***cohesive*** national CVD strategy for health systems

- Health ministries leading collaboration with other sectors of government
- Central-subnational coordination and policy implementation; integrated with national NCD strategies
- Health systems to focus on primary care, tertiary care, rehabilitation as an integrated unit
- Inclusive and equitable in approach with gender-focused CVD prevention and control strategies
- Financing that covers prevention, early detection, treatment and rehabilitation

To achieve three outcomes for health systems:

- Reduce premature deaths
- Reduce hospitalizations and re-hospitalizations
- Curb rise in new CVD patients

In addition to:

2. **Strengthening emergency medical services to prevent premature deaths in low- and middle-income economies.**

- Strengthen/establish emergency care networks and equip emergency medical teams with specialized training to reduce treatment delays.
- Improve emergency department diagnostics for timely and appropriate care

3. Strengthening screening and diagnostics guidelines and capacity for early detection, improved CVD risk management and secondary prevention.

- Ensure screening and diagnosis guidelines are comprehensive and up to date with global best practices.
- Establish screening guidelines for hyperlipidemia and strengthen hyperlipidemia screening programs and diagnostic capacity at primary care for China, India, Malaysia, Thailand, Vietnam.
- Screening guidelines for secondary prevention need to be established in India and Vietnam.
- Strengthen diagnostic capacity and leverage the use of evidence-backed novel cardiac biomarkers such as natriuretic peptide (NT-proBNP or BNP) and high-sensitivity troponin for earlier detection of CVDs and timely interventions.

4. Preventing rehospitalization by improving cardiac rehabilitation services.

- Develop and strengthen national guidelines for cardiac rehabilitation, ensuring seamless referral pathways, accreditation of services, regular updates to guidelines and improve adherence to guideline directed medical therapy.
- Improve uptake through digital technologies for home-based cardiac rehabilitation (CR) and ensuring multidisciplinary care and family involvement.

5. Tackling rising CVD risk factors, unhealthy diets, obesity, and physical inactivity, through comprehensive multi-sectoral policy changes and awareness programs.

- Strengthen obesity screening and management programs to tackle child obesity.
- Reformulate processed foods and snacks within healthy limits.
- Relevant authorities to promote physical activity within the community, public spaces, and workplace.

6. Strengthening critical enablers of CVD care: monitoring and evaluation systems, human resources, digital health solutions, and research.

- Establish effective monitoring and evaluation systems for health system capacity and performance that inform national policy and programs.
- Drive the development of digital infrastructure and CVD solution adoption by providing a clear digital roadmap.
- Tailor CVD strategies to local populations by advancing national research, development, and innovation capabilities.
- Strengthen CVD care capacity across the continuum through workforce development plans.

INTRODUCTION

Background

3 in 4

deaths worldwide due to NCDs

Health systems face an escalating burden of non-communicable diseases (NCDs) which include cardiovascular disease (CVD), diabetes, kidney, and liver disorders. These diseases, which are caused by genetics, physiology, social and environmental factors, are defined by the World Health Organization (WHO) as "chronic" because of their long duration. According to WHO, NCDs account for 3 in 4 deaths worldwide.

CVD – which refer to several conditions affecting the heart and blood vessels – is the leading killer among chronic diseases. Unfortunately, 6 in 10 global deaths from CVD occur in Asia, with over 10 million people in 2019 alone.[1]

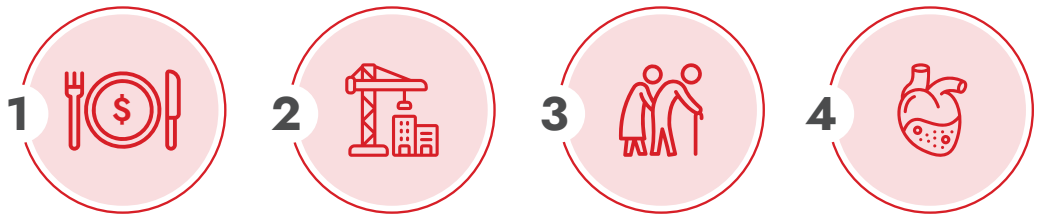
CVD is especially lethal because it can go undetected until someone experiences an acute, life-threatening incident requiring hospitalization – a heart attack, stroke, or cardiac arrest. Heart attacks and other chronic diseases can cause terminal heart failure, leading to costly re-hospitalization and a worse five-year prognosis than cancer. There are multiple, interlinked causes for CVD ranging from high blood pressure, high cholesterol, genetic disorders, or paediatric conditions.

The pandemic highlighted a deadly connection between infectious and chronic diseases. In March 2020, researchers in Wuhan, China, warned that underlying CVD resulted in poorer COVID-19 outcomes.[2] The UK found that people with CVD were 3.9 times more likely to have severe COVID-19 symptoms and 2.7 times more likely to die than those without CVD. COVID-19 is now increasingly seen as a risk factor for CVD and other related complications.[3]

Countries are impacted by direct economic costs to health systems — hospitalization and management of CVD patients, and indirect costs — loss of employment and productivity for the patient and caregivers. Direct spending on CVD prevention and care in the 9 countries varied from USD 0.7 billion in Indonesia as of 2021 to USD 49.5 billion in Japan (see Figure 6).[4,5] Caregiving responsibilities also fall primarily on families in Asia, unlike in other contexts where patients may receive long-term rehabilitation in an assisted living facility.

Families and caregivers face added social costs. Many experience stress, depressive symptoms, and social exclusion from being unable to participate fully in daily activities. A growing body of research also shows that caregivers have higher risks of developing CVD and high blood pressure when compared to non-caregivers.[6]

Asia is Experiencing Rapid Economic and Demographic Change



Health systems in the Asia-Pacific must grapple with three distinct trends. Strong economic growth has led to Asian societies spending and eating more. In 2021, the World Economic Forum estimated that 55% of the global consumer class is in Asia[7], with the ability to spend at least USD11 a day. Caloric intakes in Southeast Asia increased from 2,194 to 2,686 kcal/person/day from the 1980s to 2010s.[8]

Asia's growth has been powered in part by rapid urbanization. This also increased demand for public services such as healthcare delivery. From 1990 to 2020, Southeast Asia's urban population increased from 32% to 50% even as the region grew by 200 million people.[9] As more people work in services and manufacturing in and near cities, rural areas in Asia face growing disparities in access to healthcare and public services.

Lastly, some Asia-Pacific health systems face the challenge of ensuring fiscally sustainable health systems amidst rapidly aging societies. The speed of aging has surpassed that in Europe and the US.[10] High-income countries will likely to see increased CVD hospitalizations and higher healthcare spending (pensions and national insurance) as the proportion of those above 70 increases. Japan and South Korea have seen populations decline with aging societies. In contrast, immigration kept Australia's population stable even as the elderly grew from 12 to 16% (1995-2020).[11] Other countries are 'growing old before becoming rich.' Upper middle-income China and Thailand face pressure to care for their growing elderly population while avoiding unsustainable social safety spending.

Spurring Regional CVD Action: the Creation of the Asia-Pacific Cardiovascular Disease Alliance

CVD is a complex health problem with multiple risks, causes, types, and broader trends that have led to an upswing in the CVD burden in the Asia-Pacific. Governments and health officials are increasingly aware of the need to tackle CVD and other chronic diseases. One of the top health priorities of the Association of Southeast Asian Nations (ASEAN) Post-2015 Health Development Agenda is the prevention and control of NCDs.[12] The Asia-Pacific Economic Cooperation (APEC) Health Working Group's objectives are to "support healthy populations across the life course, including the prevention and control of NCDs".[13] At a global level, UN member states have called for action with a 2018 Political Declaration on NCDs.[14] However, we have yet to see concerted action to address specific gaps in CVD prevention and control. Public and policy awareness of the CVD burden on health systems is also low. A global survey showed that awareness of heart failure as the top cause of hospitalization in over-65s was significantly lower in some Asian countries vis-a-vis the West.[14] Low awareness of risk factors and failure to associate it with atherosclerotic CVD (ASCVD) among Asian Pacific populations has also led to poor treatment initiation rates.[15,16]

The creation of the Asia-Pacific Cardiovascular Disease Alliance (APAC CVD Alliance), a multistakeholder collaboration between patients, healthcare professionals, academia, nonprofit organisations, community partners, policymakers and the private sector aims to address this gap. The Alliance, launched in June 2023, intends to inspire policy change by elevating public and policy awareness of CVD's impact on public health and of the urgent need to tackle CVD with sustainable, scalable innovations in policy, care models, products or services.

This report identifies current CVD policy gaps across nine health systems in the Asia-Pacific – Australia, China, India, Indonesia, Japan, Malaysia, South Korea, Thailand, and Vietnam – and proposes regional policy recommendations that governments and other stakeholders can consider in their specific contexts.

Not Just the Old, Urban, or Rich: Everyone is at Risk

We aim to dispel three myths of CVD.

1

First, that CVD is inevitable in old age. While there will likely be more people with CVD due to aging societies, the reality is that people diagnosed with CVD in Asia are increasingly younger than in the West. Asian patients with heart failure were on average ten years younger. In Malaysia, heart failure patients are diagnosed at 60 years of age, versus 70 years in Western countries.[17] Half of all Vietnamese hospitalized with ischemic heart disease are 64 years and under.

2

Second, that CVD is solely a problem for urban city-dwellers. While Asia has seen rapid urbanization rates over the last 20 years, people living in rural areas are increasingly at risk. Some countries have experienced rural depopulation, which worsens access to treatment. Since 2008, CVD death rates in rural China have regularly exceeded those in urban areas.[18] In India, 15 to 49 years of age in rural areas were more likely to experience both a faster increase in obesity and diabetes, and a higher prevalence of these risk factors.[19] Rural patients in Japan are more likely to be undiagnosed, with a third not diagnosed before suffering an acute incident.

3

Third, only high-income economies are affected by CVD. Low and middle-income economies also see a significant CVD burden. With a GDP per capita of $39,827 (current 2021 USD), Japan has a death rate of 73.6 per 100,000. At the other end of the income spectrum, India ($2,238) has a death rate of 279.2.

Every Country Needs a *Cohesive* CVD Strategy

This report suggests that every country needs a nationally cohesive strategy to effectively tackle CVD as a complex health problem. We define a cohesive strategy as a policy or plan which adopts a systemic whole-of-government approach, based on the care continuum from prevention, early detection, and treatment to rehabilitation. Strategies should not focus on one aspect alone, but incorporate the entire patient journey, types of CVD and related chronic diseases.

While health officials must lead the push towards cohesion, it is crucial to work with sectoral colleagues to secure adequate resources and address social and commercial determinants of health. Governments should design ways of partnering with the private sector in healthcare delivery and systems strengthening. Central and sub-national governments must find mechanisms to fairly implement and regularly evaluate their CVD strategies across different subnational contexts. Health systems must encourage primary, specialist and step-down care to work in prevention and care management, especially following an acute incident.

Given that CVD types and the level of the disease burden differ across the Asia-Pacific region, each country must implement a tailored these aspects of a national cohesive CVD strategy.

Each CVD strategy should prioritize three outcomes:

1. Reduce premature deaths.
2. Reduce hospitalizations and re-hospitalizations.
3. Curb the rise of new CVD patients.

These outcomes are broadly aligned with Sustainable Development Goal 3.4 to reduce premature death and disability of NCDs by 2030.

#1. REDUCING PREMATURE DEATHS

Research has shown that if governments implemented comprehensive primary and secondary prevention programmes, they could potentially prevent up to 80% of CVD deaths, especially these caused by heart attacks and stroke. Many preventable deaths also occur due to inadequate emergency response to a life-threatening incident. Emergency services usually lack attention and resources, especially in lower middle-income economies. Yet instituting basic and coordinated services in cities and rural areas can prevent many deaths. First responders must have sufficient training to identify a heart attack, stroke, or cardiac arrest. Local clinics or hospitals need to have sufficient training and diagnostics infrastructure to triage patients, before deciding whether further referrals are necessary. A cohesive strategy should first prioritize reducing preventable deaths, especially in countries with high premature death among those under 70.

#2. REDUCE HOSPITALIZATIONS AND RE-HOSPITALIZATIONS

Hospitalizations from an acute CVD incident are a significant healthcare cost driver. In Australia, CVD hospitalizations and emergency care at public hospitals from 2019 to 2020 cost USD3.7 billion, nearly half of all government spending on CVD.[21] A study on heart failure hospitalizations ranged from USD10,800 per patient in South Korea to USD1,776 in Malaysia; patients were warded for at least ten days.[22]

Reducing hospitalizations also means diminishing the likelihood of life-threatening CVD incidents. One way is to ***detect CVD risk factors early to mitigate risk***. Strengthening primary care screening and diagnostics capacity is crucial. Diagnostics guidelines should cover biomarker-based tests investigating cholesterol, heart function, and kidney function. Primary care practitioners also need clear clinical guidelines to aid first-level patient management.

Reducing re-hospitalizations is essential to ensure that existing CVD patients do not suffer recurring life-threatening incidents. ***Patient management after discharge is necessary to reduce the risk of a repeat incident***. Secondary prevention and cardiac rehabilitation programs should have sufficient coverage, while taking steps to boost adherence.

#3. CURB THE RISE OF NEW CVD PATIENTS

A cohesive strategy must include a healthier, productive future for successive generations. Health promotion and prevention programs go upstream to delay the onset and slow the rise of CVD at a population level. Despite a time lag between such programs and outcomes, policymakers must invest today to create sustainable health systems in the future.

Multisectoral prevention and promotion programs are needed to spur behavioural change. Health officials may have to work with counterparts from urban planning, rural affairs, education and sports, and transport. Other community stakeholders should be included in such programs, including fostering greater CVD awareness and regular screening.

Enabling Outcomes

Above all, health systems enablers are the foundation of a cohesive strategy and achieving these three outcomes. Appropriate financing is necessary for public and private providers to manage their patients and ensure prevention programs are adequately resourced. Patient data must be tracked and accessible across different healthcare settings to give policymakers and health system leaders a clear picture. Health professionals need to work together while continuing education that equips them to perform at the top of their license.

Acting cohesively now will prevent unnecessary deaths, disability, and set the stage for a sustainable health system.

KEY REGIONAL ISSUES

The Disease Burden of Cardiovascular Diseases

CVD is the leading cause of death in the Asia-Pacific, with over 10 million deaths (or approximately 35% of total deaths) caused by CVD in 2019.[23] High premature mortality plagues Asia-Pacific countries, with CVD causing nearly 2 in 5 deaths under 70 years of age.[24] Understanding the patterns of CVD faced across the Asia-Pacific is crucial to reducing its economic and health costs and improving heart health.

CVD is a broad term for disorders affecting the heart and blood vessels, most commonly associated with plaque build-up in the arteries (atherosclerosis), blood clots, and dysfunctional heart conditions (Table 1). While ischemic heart disease and stroke are the most common CVDs, atrial fibrillation is growing rapidly. These conditions have also led to growth in heart failure hospitalizations, a deadly killer with a worse 5-year prognosis than some cancers.

Table 1: Description of selected major CVDs.[24]

Major CVDs	Description
IHD	Ischemic heart disease, or coronary heart disease, refers to heart conditions caused by narrowed coronary arteries supplying blood to the heart muscle. The narrowing can be caused by a blood clot, blood vessel constriction and most often plaque (atherosclerosis). If blood flow to the heart muscle is completely blocked, this causes a myocardial infarction (MI), or heart attack.
Stroke	Strokes are caused when blood supply to parts of the brain is cut off, preventing the brain from receiving oxygen and causing brain cells to die. The lack of blood supply can be caused by the lack of blood flow (ischemic) or bleeding (haemorrhagic).
Atrial Fibrillation	Atrial fibrillation is the most common type of arrhythmia, or irregular heartbeat. It reduces the body's ability to pump blood efficiently, which may cause blood to flow back and form clots in the heart's atria. Hence, atrial fibrillation can increase risk of stroke. In addition, atrial fibrillation can be asymptomatic and frequently remains undiagnosed.
Heart Failure	Heart failure occurs when the heart is unable to pump enough blood sustainably to meet the body's needs. It can manifest acutely, or as a progressive long-term condition. Oftentimes, heart failure develops when different conditions damage or weaken the heart, such as hypertension, ischemic heart disease, atrial fibrillation, or unhealthy lifestyles.

ISCHEMIC HEART DISEASE AND STROKE

Deaths from ischemic heart disease (IHD) and stroke are trending upward across all Asia Pacific countries except for Australia, which still reports substantial mortality rates from these two major CVDs. China reported the highest IHD mortality rates, followed by Japan, India, Malaysia, and Australia. Deaths caused by stroke were highest in China, followed by Vietnam, Indonesia, and Japan.

IHD and stroke are the most common CVDs in the Asia-Pacific. In most Asia-Pacific countries, IHD and stroke incidence, the number of new cases per year, rose by 10 – 45% over the past decade (2009 - 2019).

- Australia was the only country that saw a decline in IHD and stroke mortality rates. However, incidence of IHD remained highest across all nine Asia-Pacific countries in the study at 586 new cases per 100,000 population (Table 2)
- South Korea was the only country where IHD incidence declined slightly. However, stroke incidence saw the most significant increase (43.8%) amongst the Asia-Pacific countries.

Table 2: Mortality and incidence of ischemic heart diseases and stroke in the nine Asia Pacific countries.[26]

	Ischemic Heart Diseases		Stroke	
Country	Incidence per 100,000 (+/-% from 2009-19)	Mortality per 100,000 (+/-% from 2009 to 2019)	Incidence per 100,000 (+/-% from 2009 to 2019)	Mortality per 100,000 (+/-% from 2009 to 2019)
AUS *	586.1 (+1.8%)	108.4 (-6.4%)	103.9 (+3.8%)	52.0 (-2.1%)
JPN	341.5 (+26.5%)	110.0 (+16.7%)	317.0 (+11.4%)	113.2 (+17.9%)
KOR **	174.0 (-5.8%)	53.0 (+22.3%)	170.8 (+43.8%)	68.4 (+6.93%)
CHN	246.1 (+32.7%)	131.8 (+33.1%)	276.7 (+32.6%)	153.9 (+7.4%)
MYS	155.0 (+21.9%)	108.7 (+17.4%)	153 (+21.38%)	63.7 (+22.5%)
THA	177.5 (+35.8%)	73.6 (+31.0%)	175.6 (+22.1%)	72.8 (+31.8%)
IND	341.1 (+18.2%)	109.2 (+22.7%)	92.9 (+26.5%)	50.3 (+11.9%)
IDN ***	68.8 (+16.0%)	94.6 (+17.8%)	247.8 (+20.0%)	127.7 (+15.5%)
VNM	213.1 (+27.7%)	77.5 (+28.8%)	139.8 (+24.7%)	141.1 (+0.25%)

*In Australia, periphery artery disease (186.6, +10.1%) and atrial fibrillation incidence was higher than stroke incidence
** In South Korea, periphery artery disease incidence (185.7, +22.3%) was highest among CVDs.
*** In Indonesia, periphery artery disease incidence (130.8, +22.3%) was 2nd highest, after stroke.

IHD and stroke are the largest contributors of CVD burden in terms of deaths and disabilities across the nine Asia-Pacific countries.

- Stroke comprise the largest CVD burden in Japan, South Korea, China, Thailand, Indonesia, and Vietnam, seeing a rise in CVD burden of 4.7 to 16.1% between 2009 to 2019.
- Whereas in Australia, Malaysia, and India, IHD caused the largest CVD burden, with Malaysia and India seeing an uptick in CVD burden of 13.4 to 13.7% in 2009 to 2019.

Table 3: Disease burden of ischemic heart diseases and stroke in the nine Asia-Pacific countries.[27]

	DALYs per 100,000 (+/-% from 2009 to 2019)	
	Ischemic Heart Diseases	Stroke
AUS *	1,516 (-11.0%)	769 (-4.4%)
JPN	1,437 (+2.1%)	1,929 (+5.4%)
KOR	825 (+5.7%)	1,377 (-3.1%)
CHN	2,439 (+22.7%)	3,231 (+4.7%)

	DALYs per 100,000 (+/-% from 2009 to 2019)	
	Ischemic Heart Diseases	Stroke
MYS	2,509 (+13.4%)	1,638 (+17.6%)
THA	1,463 (+20.5%)	1,817 (+16.1%)
IND	2,677 (+13.7%)	1,246 (+6.6%)
IDN	2,366 (+14.3%)	3,240 (+11.8%)
VNM	1,569 (+29.4%)	3,192 (+4.1%)

The high IHD and stroke burden in the nine Asia-Pacific countries were fuelled by common lifestyle-related factors: high systolic blood pressure, dietary risks, and high low-density lipoprotein (LDL) cholesterol.

Table 4: Top IHD risk factors in 2019 based on DALYs contribution.[28]

Ranking	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
1	Dietary risks	High systolic blood pressure	Dietary risks	Dietary risks	High systolic blood pressure	High LDL cholesterol	Dietary risks	High systolic blood pressure	High systolic blood pressure
2	High systolic blood pressure	Dietary risks	High LDL cholesterol	High systolic blood pressure	High LDL cholesterol	Dietary risks	High systolic blood pressure	Dietary risks	Dietary risks
3	High LDL cholesterol	High LDL cholesterol	High systolic blood pressure	High LDL cholesterol	Dietary risks	High systolic blood pressure	High LDL cholesterol	High LDL cholesterol	High LDL cholesterol
4	High body-mass index	Tobacco	Tobacco	Tobacco	Tobacco	Tobacco	Air pollution	Tobacco	Tobacco
5	High fasting plasma glucose	High fasting plasma glucose	High fasting plasma glucose	Air pollution	High body-mass index	Air pollution	High fasting plasma glucose	Air pollution	High fasting plasma glucose

High systolic blood pressure, dietary risks, and high low-density lipoprotein (LDL) cholesterol were the top 3 contributing risk factors toward IHD disease burden in all nine countries. In seven out of nine countries, tobacco usage was the fourth highest contributor to the IHD burden. High resting plasma glucose, air pollution, and high body-mass index (BMI) rounded off the top 5 major contributors to IHD burden (Table 3).

Across all nine Asia-Pacific countries, high systolic blood pressure ranked as the top contributor to stroke disease burden.

Dietary risks were the next most significant stroke risk factor in six of the nine countries, ranking third in Australia, India, and Malaysia. In all countries except Australia, tobacco featured in the top five risk factors contributing to stroke disease burden. High BMI and air pollution also featured prominently in the top five stroke risk factors in six out of nine countries (Table 4).

Table 5: Top stroke risk factors in 2019 based on DALYs contribution.[29]

Ranking	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
1	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure
2	High body-mass index	Dietary risks	Dietary risks	Dietary risks	High body-mass index	Dietary risks	Air pollution	Dietary risks	Dietary risks
3	Dietary risks	Tobacco	High fasting plasma glucose	Air pollution	Dietary risks	High body-mass index	Dietary risks	High body-mass index	Air pollution
4	High fasting plasma glucose	High fasting plasma glucose	Air pollution	Tobacco	High fasting plasma glucose	Air pollution	Tobacco	Air pollution	Tobacco
5	High LDL cholesterol	High LDL cholesterol	Tobacco	High body-mass index	Tobacco	Tobacco	High body-mass index	Tobacco	High fasting plasma glucose

Asia-Pacific populations may be at higher risk of CVDs due to hereditary factors.

Familial hypercholesterolemia (FH) is a genetic disease predisposing affected individuals to high cholesterol levels. FH is more common in populations living in the Asia-Pacific region, with an estimated prevalence of 1 in 200 - 360 persons, or 15 million people with FH.[30] Often underdiagnosed and undertreated, families with a history of FH are more susceptible to premature atherosclerotic CVD (ASCVD). Ethnicities with South Asian ancestry such as the Indian population are also at higher risk of ASCVD, due to them being at more susceptible in developing other contributing co-morbidities such as diabetes, abdominal obesity, and hypertension.[31,32]

Ischemic Heart Disease and Stroke

Ischemic heart disease occur more commonly in males than females in all nine Asia-Pacific countries.

In 2019, the incidence of new IHD cases in males was higher in the nine Asia-Pacific countries, with the incidence of male IHD cases in Australia and Indonesia being 2.5 times higher than female IHD cases. Similarly, there are more current cases of IHD in males in most Asia-Pacific countries except China. The prevalence of current IHD cases in Australia is nearly three times higher in males compared to females.

However, stroke cases are more frequent among females in most Asia-Pacific countries.

Except for Thailand and Vietnam, the other seven Asia-Pacific countries had higher stroke incidence in females than males. Prevalence of stroke cases in females remained higher in most Asia-Pacific countries save Vietnam.

Figure 1: Prevalence and incidence of IHD and stroke by gender across nine Asia-Pacific countries in 2019.[33]

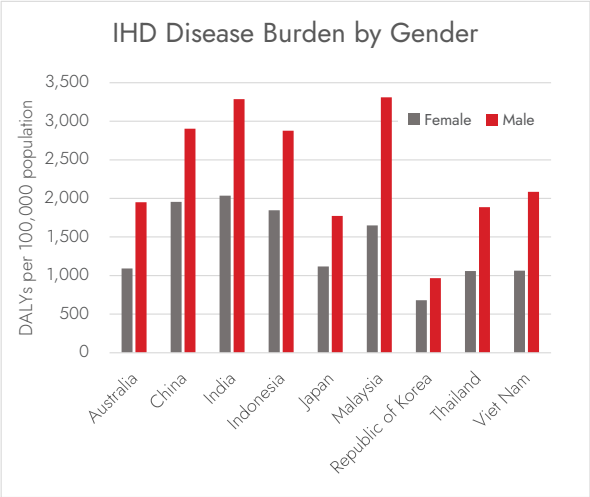
Males experienced greater IHD disease burden across all nine Asia-Pacific countries.

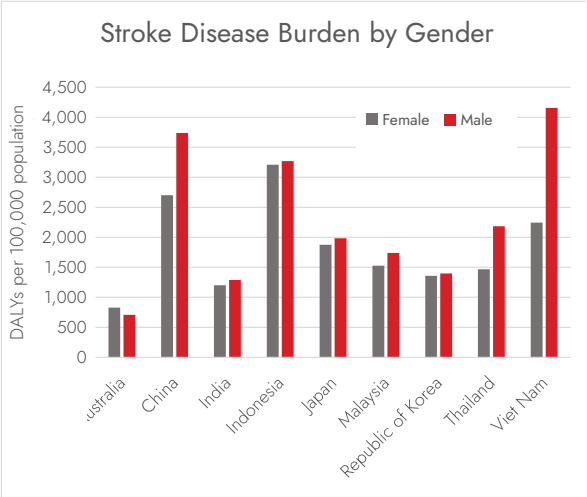
IHD disease burden in Malaysian and Vietnamese males is twice as much as females, whereas for the other countries, male IHD burden is 1.5 to 1.8 times higher than that of females (Figure 2).

Most Asia-Pacific countries also have a higher stroke burden in the male population.

In particular, China, Thailand, and Vietnam report 1.3 to 1.9 times more stroke burden among males compared to females. In Australia, the stroke disease burden in the female population remained higher than in the male population (Figure 2).

Figure 2: Disease burden of IHD and stroke by gender across nine Asia Pacific countries in 2019.[34]





ATRIAL FIBRILLATION

Atrial Fibrillation (AF) is a rapidly growing CVD in the Asia-Pacific region.

Eight out of the nine Asia-Pacific countries reported at least a 20% rise in new AF cases between 2009 to 2019, with China and Thailand reporting a 40% increase in new AF patients. Among the countries, Australia reported the highest incidence (145.6 per 100,000 population) and highest mortality (13.9 per 100,000 population) from AF, which continues to rise (Table 5).

Table 6: Mortality and incidence of atrial fibrillation in the nine Asia Pacific countries.[35]

	Atrial Fibrillation	
Country	Incidence per 100,000 (+/-% from 2009-19)	Mortality per 100,000 (+/-% from 2009 to 2019)
AUS *	145.6 (+12.1%)	13.9 (+16.6%)
JPN	42.2 (+32.5%)	10.3 (+48.3%)
KOR	40.9 (+29.3%)	3.8 (+68.4%)
CHN	81.9 (+42.8%	3.6 (+53.0%)
MYS	53.1 (+30.5%)	2.3 (+49.4%)
THA	85.8 (+43.1%)	5.0 (+74.0%)
IND	50.5 (+24.5%)	2.1 (+69.9%)
IDN	54.8 (+24.3%)	1.9 (+32.5%)
VNM	60.3 (+28.2%)	3.2 (+26.8%)

*In Australia, the incidence of atrial fibrillation was the third largest CVDs after ischemic heart disease and periphery artery diseases.

Growing AF cases are accompanied by a sharp rise in deaths, as eight countries report a 26% to 74% rise in AF-related deaths.

Notably, Japan has the second highest AF mortality rates, despite the incidence being less than one-third that of Australia. From 2009 to 2019, AF-related deaths sharply rose in Thailand (74%), India (70%), and South Korea (68.4%) (Table 6).

Table 7: Top atrial fibrillation risk factors in 2019 based on DALYs contribution.[36]

Ranking	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
1	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure	High systolic blood pressure
2	High body-mass index	High body-mass index	Alcohol use	Dietary risks	High body-mass index	High body-mass index	High body-mass index	High body-mass index	Tobacco
3	Alcohol use	Alcohol use	High body-mass index	High body-mass index	Dietary risks	Alcohol use	Tobacco	Tobacco	High body-mass index
4	Tobacco	Tobacco	Tobacco	Tobacco	Tobacco	Dietary risks	Other	Dietary risks	Alcohol use
5	Other	Dietary risks	Dietary risks	Alcohol use	Alcohol use	Tobacco	Dietary risks	Other	Dietary risks
6	Dietary risks	Other	Other	Other	Other environmental risks	Other	Alcohol use	Alcohol use	Other

High systolic blood pressure was the top contributor to AF disease burden across all nine Asia-Pacific countries.

High body-mass index was the next largest contributor to AF burden in six Asia-Pacific countries ranking third in China, South Korea, and Vietnam. Tobacco use was a major risk factor contributing to AF burden across all countries, and notably the second largest contributor to AF burden in Vietnam. Dietary risks, and alcohol use featured in the top five contributors to AF burden in eight, and seven of the Asia-Pacific countries, respectively.

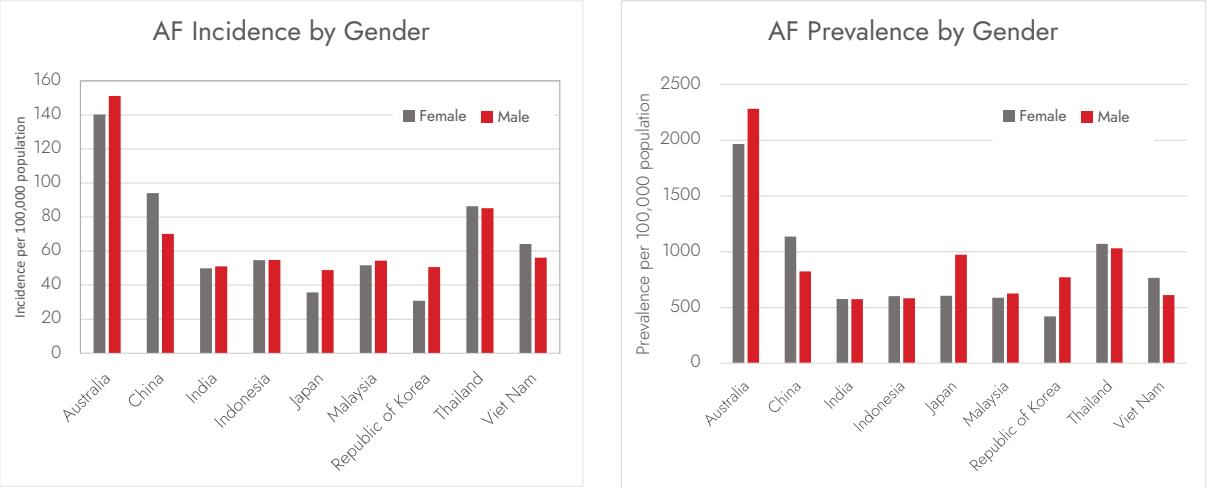
In addition to lifestyle-related risk factors, ageing is an increasingly influential AF risk factor across the nine Asia-Pacific countries.

AF becomes more prevalent with advancing age. Among Asia-Pacific countries with large older adult populations, one in four Australian adults and one in five Chinese adults are at risk of developing AF in their lifetime.[37]

Gender differences in AF

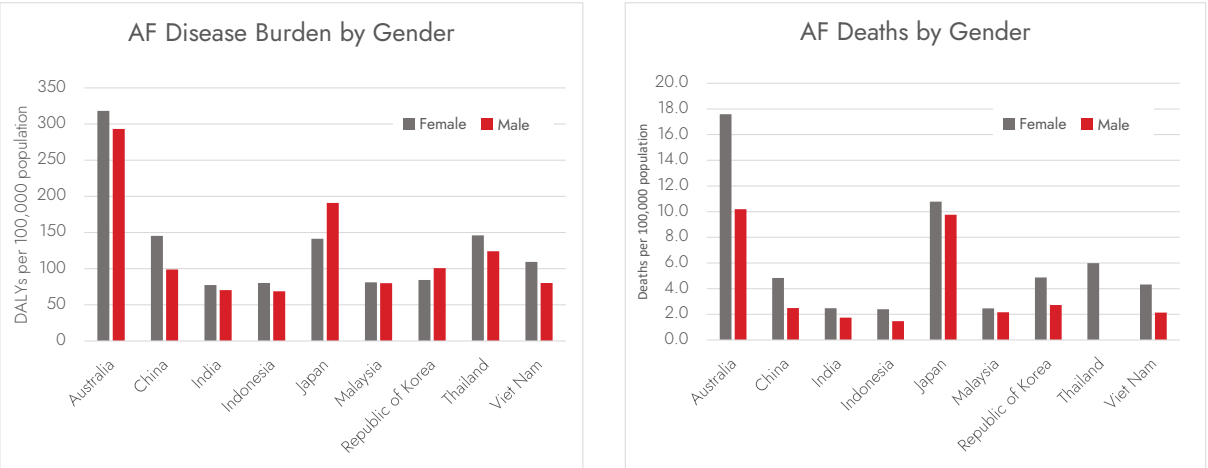
In China, Vietnam, and Indonesia, AF is more common and is seeing a greater increase in the female population than the male population. Conversely, male cases of AF occur more frequently in Australia, Japan, Malaysia, and South Korea (Figure 3).

Figure 3: Prevalence and incidence of atrial fibrillation by gender across nine Asia-Pacific countries in 2019.[38]



Except for Japan and South Korea, AF related disease burden is higher in Asia-Pacific countries' female population. Deaths related to AF were higher in females across all nine Asia-Pacific countries, but particularly in Australia, China, South Korea, and Vietnam (Figure 4).

Figure 4: Disease burden & mortality rates of atrial fibrillation by gender across nine Asia-Pacific countries in 2019.[39]



Contribution of risk factors to IHD, stroke, and AF in both genders

Table 8: The contribution of risk factors to IHD, stroke, and atrial fibrillation in both genders across Asia-Pacific.

IHD	Stroke	Atrial Fibrillation
Across the nine Asia-Pacific countries, dietary risks, high blood pressure, and high LDL cholesterol are the largest contributors to IHDs disease burden in males and females.	**High blood pressure was the leading contributor to stroke burden in both males and females across all nine Asia Pacific countries.** **Dietary risks are the second largest contributor in six out of nine countries, followed by high BMI in Australia and Malaysia, and air pollution in India.**	**High blood pressure was the highest contributor of atrial fibrillation (AF) related burden in males across all nine Asia-Pacific countries.** **In Asia-Pacific countries female population, high blood pressure and high BMI contributed most to AF burden in the region.**
Interestingly, high plasma glucose is a rapidly growing contributor of IHD burden across the Asia-Pacific countries, particularly in the female population. · In the female population, IHD disease burden attributable to high plasma glucose rose significantly in India (58%), Japan (26%), Malaysia (28%), South Korea (43%), Thailand (59%), and Vietnam (35%) over the past decade. · Within the male population, IHD disease burden contributed by high glucose levels rose considerably in India (45%), Japan (17%), Malaysia (23%), South Korea (26%), and Vietnam (48%).	**Similar to IHD, high plasma glucose is one of the top five stroke risk factors and rapidly growing contributor of stroke burden amongst the female population in the Asia Pacific countries.** · The stroke burden contributed by high glucose levels rose substantially in India (46%), Indonesia (22%), Japan (27%), Malaysia (26%), South Korea (24%), and Thailand (54%). Stroke burden contributed by high plasma glucose in the male population rose greatly in India (40%), Japan (19%), Malaysia (28%), South Korea (17%), and Vietnam (28%).	
Tobacco usage is the fourth highest contributor to IHD burden in men in all Asia-Pacific countries except for Australia and India. In comparison, other CVD risk factors – namely high plasma glucose, air pollution, or high BMI – contributes a higher proportion of IHD burden in women than tobacco usage. In eight out of the nine countries, high plasma glucose is the 4th or 5th highest contributor to IHD burden in women.	**Tobacco usage is one of the top five risk factors contributing towards stroke burden in males across most Asia Pacific countries.** For the female population in the nine Asia-Pacific countries, other lifestyle, and environmental risk factors such as high plasma glucose, high LDL cholesterol, and air pollution contribute more to the growing stroke burden than tobacco usage in the region.	**Tobacco use featured within the top three risk factors contributing towards AF burden in males across eight Asia-Pacific countries.** **Alcohol use was another significant contributor towards AF burden in males, ranking within the top three AF risk factors in Australia, Japan, South Korea, Thailand, and Vietnam.**

HEART FAILURE

Heart failure is a growing epidemic in the Asia-Pacific.

people estimated to have heart failure in the region

The combination of an ageing population and increasing rates of chronic diseases including hypertension, diabetes and obesity has fuelled the growing heart failure burden in the region. The absence of reliable surveillance data on heart failure prevalence and incidence obscures its true burden from policymakers and healthcare providers. However, estimates of heart failure prevalence in the Asia-Pacific region ranged from 1.26% to 6.7%, or around 32 million people in the region.[40,41] Heart failure-related readmission rates contribute to the high disease burden, with around 6 million admissions per year in the Asia-Pacific region.[42] The heart failure burden is expected to have risen with the COVID-19 pandemic, as the virus increased patients' risk of heart failure by 72% within the first year of infection.[43]

Multimorbidity in heart failure patients is becoming increasingly common in the Asia-Pacific countries.

Around two in three heart failure patients have at least two other comorbidities in Asia.[44] Across the nine Asia-Pacific countries, there were at least five patterns of multimorbidity identified amongst heart failure patients. First, the ***elderly with atrial fibrillation*** phenotype, most prevalent in Australia, Japan, South Korea, and Vietnam. Next, sub-populations with ***metabolic diseases*** such as obesity, hypertension, and diabetes, which mainly consisted of patients from Malaysia, Vietnam, and Australia. Third, a ***younger patient population with more co-morbidities***, is more common in China, India, Japan, South Korea, and Thailand. Fourth, ***heart failure patients with existing ischemic heart diseases (IHDs)***, are found in Australia, India, Indonesia, Malaysia, and Vietnam. Last, a ***lean-diabetic*** (diabetic and low BMI) patient profile is chiefly found in Malaysia.[45,46,47] The diversity of heart failure patient demographics calls for more targeted interventions to reduce the growing disease burden in Asia Pacific countries.

However, heart failure care remains challenged by a lack of patient and physician awareness, limited screening & diagnosis capacity, high cost of treatment, and fragmentation of care services across the continuum.

A recent survey carried out by the Asian Pacific Society of Cardiology (APSC) among physicians in the APAC region showed that patient and physician awareness along with lack of access to testing, have caused delays in receiving timely treatment.[48] Moreover, the lack of follow-up care, secondary prevention, and cardiac rehabilitation services has also led to poorer long-term patient outcomes for heart failure patients. High costs and lack of funding for heart failure treatment also presented a major challenge for access, with only 17% of surveyed patients being fully publicly funded for heart failure medications and devices, while 53% received reimbursements with co-payments.[49]

Five patterns of multimorbidity identified amongst heart failure patients:

1. Elderly with atrial fibrillation.
2. Metabolic diseases
3. Younger patient population with more co-morbidities
4. Heart failure patients with existing ischemic heart diseases (IHDs)
5. Diabetic patients

ECONOMIC BURDEN OF CVD

CVD ranks amongst the top 3 causes of death and disability in all nine countries. Spending on CVD prevention and care by governments, excluding indirect costs, in the nine countries vary from USD 0.7 billion in Indonesia to USD 49.5 billion in Japan.[50,51] Stroke and ischemic heart disease together account for most spending on CVD prevention and care.

In Australia, the most expensive cardiovascular conditions in 2019–20 were ischemic heart disease, atrial fibrillation, and stroke. An estimated:

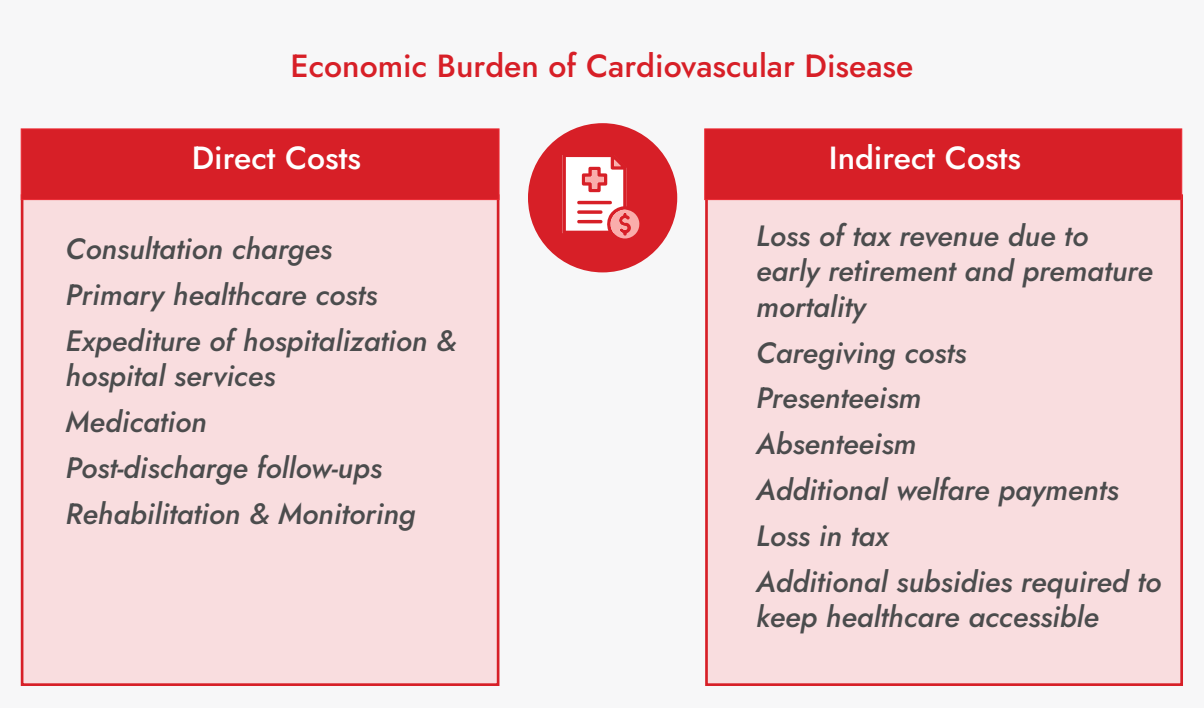
18.8%
of CVD expenditure
($1.7 billion)
was spent on
ischemic heart disease

10.3%
of CVD expenditure
($0.9 billion)
was spent on
atrial fibrillation

7.0%
of CVD expenditure
($0.6 billion)
was spent on
stroke

The following figure presents the direct and indirect costs associated with CVD.

Figure 5: Direct & indirect costs associated with CVD

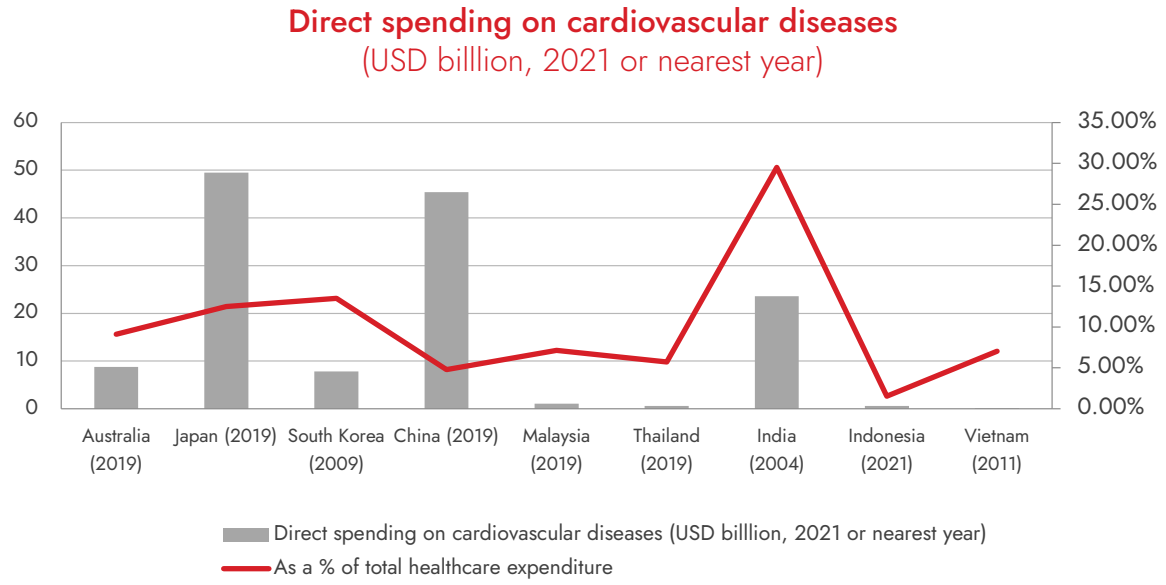


In total, the nine countries spend more than $177.9 billion USD on direct healthcare costs for CVD.

Direct CVD costs range from 1.5% to 13.5% of total health expenditure. Treatment costs rise dramatically with hospitalization – nearly 70% of CVD expenditure in Australia 2019-2020, USD 6.1 billion, was spent on hospital services.[52] Reported mean total hospitalization costs per patient range from USD 1,744 and USD 690 for ischemic heart disease and stroke, respectively, in Vietnam in 2013 to USD 15,075 and USD 8,011 in Australia for emergency treatment of acute coronary syndrome and other cardiovascular conditions respectively in 2011.[53,54]

There is limited data on the economic burden of CVD. The figure below shows direct healthcare spending on CVD for Australia, Japan, South Korea, China, Malaysia, Thailand, India, and Indonesia for the most recent year where data was available.[55,56,57,58,59,60,61,62] Data for Vietnam was not available; the direct costs of inpatient and outpatient care for smoking-attributable CVD were taken as an estimate for economic burden in the country.[63]

Figure 6: Direct spending on cardiovascular diseases across the nine countries.



Source: Analysis based on secondary research. For methodology, refer to page 89

A study in Australia estimated per person and population-level lifetime costs for cardiovascular disease in 2019 at

AUD 65,700

(USD 45,700)

and for the population at

AUD 60.5 billion

(USD 42.07 billion)[64]

After being discharged, patients must undergo cardiac rehabilitation and be closely monitored to ensure they follow the post-discharge treatment plan and adhere to a daily medicine regimen – this step is critical in preventing secondary cardiac events and readmissions. Consequently, there are lifetime costs associated with managing CVD.

Asian countries are seeing both increasing prevalence and an earlier onset of heart failure (HF) – a degenerative condition with severe health and economic implications.

Pre-existing underlying heart conditions can progress into heart failure, where the heart is unable to pump blood effectively to meet the body's needs. Heart failure affects about 2–3% of the world's population and is a ***leading cause of hospital admissions***, particularly among the elderly.[65] Heart failure necessitates frequent clinic visits due to the worsening of symptoms.[66]

In addition to its adverse effects on health, HF imposes substantial financial burdens on patients, caregivers, communities, and governments. HF accounts for approximately 2–3% of the overall expenses for medical conditions.[67] Per patient costs for heart failure hospitalization range in Asia have an average cost of $4,183 (median cost of $3,508), with patients needing to be

readmitted in the case of poor management of HF.[68] The extended lifespan of individuals with heart failure contributes to its higher occurrence, consequently amplifying its health and economic impact.[69] The presence of comorbidities can double the costs of HF.[70] On a global scale, the estimated cost of HF in 2017 was a staggering USD 346 billion.[71]

Figure 7 below shows that more than half of heart failure expenditure costs over a two year period stem from follow-up visits including readmission costs which are more likely when HF is poorly managed. A study carried out in 2010 in the US found a steep increase in costs for patients who experienced a secondary CVD admission when compared to those who had only been hospitalized once: ($62,755 vs $13,509, P <.001).[72]

Figure 7: Breakdown of HF costs.[73]

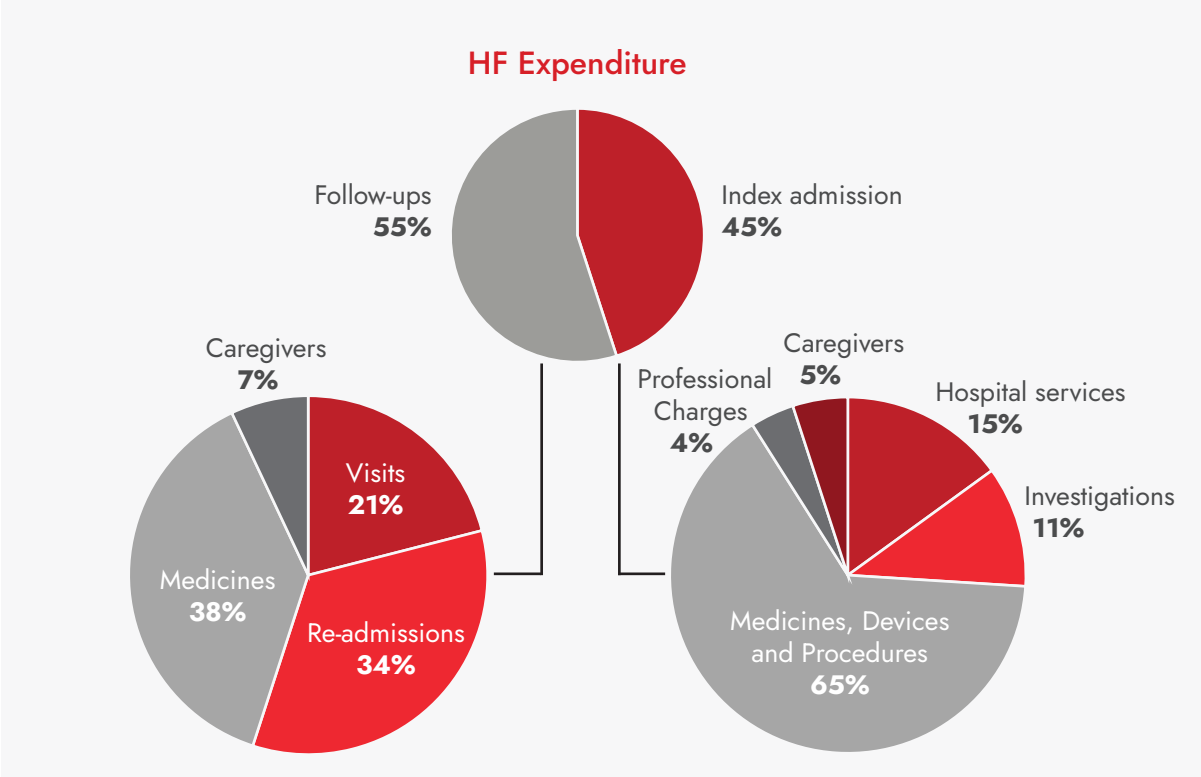


Table 9 below provides a glimpse into the high costs of heart failure hospitalization in Malaysia, South Korea, and Thailand. The length of stay averaged more than 12.2 days except in Malaysia.[74]

Table 9: Economic burden of heart failure in Malaysia, South Korea, and Thailand.[75]

	Heart failure cost per patient (2021)	Hospitalized heart failure care costs (2021)
Malaysia	$1,443	$1,776
South Korea	$2,357	$10,714
Thailand	$3,513	$7,181

Malaysia

The economic burden of heart failure in Malaysia has been estimated at approximately **USD 481.9 million annually, accounting for about 1% of the total health expenditure in 2021.**

The yearly cost burden escalated from USD 2.8 million for patients aged 20-29 to a substantial USD 142.1 million for those aged 60-69. Managing heart failure in patients aged 50-79 years contributed a substantial 74.1% to the total financial burden of HF in Malaysia.[76]

Japan

A total of $1.187 billion/year (44% of the hospitalization costs for acute CVDs) was spent on patients with heart failure between 2014-2018. Median costs per patient were $8,089 per episode. **The costs associated with HF for patients over 75 years of age accounted for 68% of the total cost.**[77]

The increasingly early onset of heart failure and multi-morbidities in Asia are driving up hospitalization costs.

Findings from the Asian HF registry indicated that individuals afflicted by heart failure in Asia are almost a decade younger than their Western Europe and North American counterparts.[78] Patients with HF admissions in India were 53 years old compared to patients in the West who were around 70 years old.[79] Moreover, two in three patients have multi-morbidities, which can double the costs of treatment.[80,81]

The findings also show that low-income countries with the youngest patients had the poorest outcomes. This has been ascribed to delays in disease diagnosis, gaps in guideline therapy, limited access to healthcare, and less developed healthcare infrastructure.[82]

India leads in HF expenditure in South Asia, approximated at around $1.19 billion.[83] HF hospitalization costs totalled $1.9 billion in China in 2019.[84]

Treatment gaps due to the lack of financial coverage further increase the economic burden.

Out-of-pocket-expenses (OOP) are well-above the recommended limit of 20% in South Korea, China, Malaysia, India, Indonesia, and Vietnam. Within communities, OOP costs are higher for households with low socio-economic status and for older age groups with multi-morbidities.[85,86] Without adequate financial coverage for both early prevention and treatment, patients from these groups are likely to face catastrophic financial expenditure and worsening health conditions which will increase the economic burden.

The indirect costs of CVD to the economy far exceed healthcare costs.

Heart disease takes a toll on patients and their caregivers. Apart from the direct costs incurred as a result of care, indirect costs to the health system accrue from the following factors: absenteeism, presenteeism or the loss of productivity at the workplace, informal caregiving costs, tax revenues lost as well as welfare payments.

Indonesia

In 2018, nearly 2 million (1.45%) Indonesians of working-age had ischemic heart disease (IHD). In Indonesia, the percentage of productivity loss attributable to ischemic heart disease due to absenteeism and presenteeism was estimated to be 2.8% and 6.8% of GDP per year, respectively. By retirement age, the estimated economic impact of lost productivity amounted to USD33.3 billion, and healthcare costs to USD139 billion.[86]

India

The WHO estimated that India lost USD 9 billion in national income from premature deaths due to heart disease, stroke and diabetes in the year 2005[17] which are expected to cumulatively lead to losses of USD 237 billion over the next 10 years.[17]

Malaysia

CVDs also accounted for 44.1 per cent (RM 1.15 billion) of productivity loss due absenteeism in 2017.

The average annual days of absenteeism or being absent from work per individual due to stroke was the highest at 17.94 days, followed by heart disease at 7.89 days, and hypertension at 6.39 days.

CVDs accounted for 26.57 per cent (RM 1.6 billion) of presenteeism loss — the loss of productivity resulting from people who are still present at work but not working at their full capacity.[88]

Australia

Over a third of people with stroke had a resulting disability. Additionally, a national survey in Australia found that 81% of stroke survivors reported significant levels of unmet need in the community after discharge from hospital.[89]

58% of primary carers of people with stroke and disability spend 40 hours or more per week in their caring role:[90]

- 21% report a decrease in income due to their caring role
- 24% incur extra expenses due to their caring role
- 31% have difficulty meeting everyday living costs

The prevalence and financial impact of cardiovascular disease (CVD) are poised to surge.

Three primary factors are driving this surge: the aging demographic, lifestyle changes, and a sustained decrease in CVD-related deaths—a phenomenon particularly noteworthy in the United States.[91] This trend is not limited to developed nations; developing countries are swiftly transitioning towards delayed degenerative diseases.

For instance, in the early 2000s, South Korea witnessed a downturn in CVD mortality, attributed to a decline in haemorrhagic stroke cases. However, the burdens of thrombotic stroke and ischemic heart disease began to rise. Studies show a substantial factor contributing to the escalation of CVD healthcare costs: the aging population, accounting for more than a 20% rise in hospitalization expenses.[4] With Japan, South Korea, Thailand, and Australia ranking amongst the top 20 aging countries and with China, Vietnam, and Malaysia aging rapidly, aging-related CVD costs in the region will escalate. Taken together with the earlier onset of heart disease in Asia and rising medical inflation amidst fewer healthcare resources, the economic burden of CVD will continue to mount unless action is taken now.[92]

Without governments investing in cohesive strategies that tackle prevention, earlier detection, and more effective management of CVD, the costs to individuals, society, and economies will only escalate further.

CVD STRATEGY EVALUATION FRAMEWORK AND SCORECARD

The framework underpinning this report theorizes that a ***cohesive dedicated CVD strategy designed along the patient pathway*** is required to drive action towards three measurable outcomes for effectively controlling CVD: reducing premature deaths, reducing hospitalization and rehospitalizations and curbing the rise in new cases. The detailed framework and scorecard can be found in the appendices.

CVD Strategy Evaluation Framework

Strength of CVD Strategy: Evaluation of policies, programs and Monitoring & Evaluation (M&E) across the patient journey

- **(A) Overall CVD policy**
- **(B) Health Promotion & Prevention**
- **(C) Screening & Diagnosis**
- **(D) Management of Established CVD**
- **(E) Health Systems Readiness**

Comprehensiveness of CVD Strategy:

- CVD Specificity
- CVD financing
- Leadership, accountability, and coordination mechanisms
- Inclusive and equitable policy formulation

Target Outcomes:

- Reduce premature deaths
- Reduce hospitalization and re-hospitalizations
- Curb new CVD cases

(A) Overall Policy

The initial framework to evaluate a country's overall CVD strategy was informed by the WHO Global Action Plan for the prevention and control of NCDs 2013-2020[93], academic research papers and grey literature on CVD policy, and iteratively from comparing countries that had dedicated CVD strategies (Australia, Japan, South Korea, Spain). Four dimensions emerged from this iterative process and initial indicators were shortlisted to evaluate overall policy across four main dimensions:

(I) CVD specificity
(II) Inclusive and equitable policy formulation
(III) Leadership, accountability, and coordinationmechanisms
(IV) CVD financing

CVD specificity looks at whether countries have a CVD-focused strategy or policy in place to frame and direct implementation towards specific CVD goals. Indicators used to evaluate this are whether: countries have an NCD policy at least; there is a separate CVD policy or strategy; targets have been set to tackle upstream risk factors that contribute to new CVD cases and worsen CVD outcomes in existing ones; there are screening and diagnostics strategies specific to CVD control; specific disease reduction goals are included and policies for maintaining the quality of healthcare for patient safety are included in the CVD strategy or policy.

Inclusivity and equitable policy formulation evaluates whether CVD strategies were informed in an inclusive manner through engaging both health provider and patient perspectives and whether the strategy or policy included equitable access to care and left out vulnerable populations.

Leadership, accountability, and coordination evaluates strategies outlining leadership at the national level, coordination of strategy between national and subnational governing bodies, between ministries, dedicated CVD programs and M&E programs dedicated to CVD.

CVD financing looks at whether a dedicated CVD budget exists and whether it is designed to comprehensively address CVD needs along the patient pathway, minimize out-of-pocket expenditure, and consider the unique needs of high-risk groups such as the elderly and patients with multiple co-morbidities.

Countries were then examined for comprehensiveness of policies and program implementation along the patient pathway:

(B) Health Promotion and Prevention

Countries were evaluated for policies and programs that addressed health promotion and prevention of upstream risk factors that contribute to CVD.

(C) Screening and Diagnosis

Countries were evaluated on the comprehensiveness of guidelines, policies and programs for screening and diagnosis and whether these were in accordance with international guidelines.

(D) Managing established CVD

Emergency service response, acute care, step down care, secondary prevention, rehabilitation, and integrated care were looked at within this section in greater detail for each segment.

(E) Health system readiness

The effectiveness of policies for health service planning and delivery were also examined to understand underlying gaps that may be driving key issues within the implementation of CVD prevention and care along the patient pathway. Seven health system factors were examined: comprehensiveness of national registries; developing and maintaining clinical guidelines; workforce planning, supply chain resilience, healthcare system digital readiness, and research, development, and innovation (RDI).

METHODOLOGY OVERVIEW

Indicators were selected for A-E based on benchmarking from countries with existing CVD strategies, WHO, EU, NICE and AHA guidelines, expert interviews, and research papers. Findings across countries from B-E were iteratively used to refine indicators within and across each section. Desktop literature, and expert and patient interviews were used in gathering data.

Nine countries in Asia Pacific (Australia, Japan, South Korea, China, Malaysia, Thailand, India, Indonesia, and Vietnam), were chosen to represent the diverse contextual differences and challenges within the region. Detailed descriptive data was consolidated for each country based on their national health policy including CVD-related policies, policy implementation and whether there were M&E programs for each component along the pathway.

A scorecard was developed from the above framework to compare and contrast findings across countries and within patient pathway segments. The scorecard was developed in three parts: a **raw indicator** sheet, a **country scorecard** of scores for subsections under sections A-E, followed by a final **regional scorecard with** the CVD indicators for each section of the framework.

Given the role of national income in determining healthcare spending, and consequently other downstream healthcare system factors, the nine countries were divided into groups based on their national income.

Grouping of countries based on national income

Group 1 High-Income	Group 2 Upper-middle Income	Group 3 Lower-middle Income
Australia (AUS)	China (CHN)	India (IND)
Japan (JPN)	Malaysia (MYS)	Indonesia (IDN)
Korea (KOR)	Thailand (THA)	Vietnam (VNM)

A detailed scoring methodology can be found in the Methodology chapter.

Countries	Policies	Health Promotion and Prevention							Screening and diagnosis						Management of Established CVD										System Readiness						
	Policies	Effectiveness of risk reduction programmes				CVD Awareness Programs	Adequate guidelines for Primary prevention of CVD in primary care centres	Overall score of health promotion and prevention pro-	Screening policies	Effectiveness of screening programs	Overall strength of screening	Comprehensiveness of diagnostics policies	Diagnostic capacity	Overall Strength of Diagnostics	Comprehensiveness of EMS planning for CVD events	Basic availability of critial care and procedure / surgery	Quality of Acute Care Services	Monitoring & rehabilitation service comprehensiveness and coverage	Availability of Essential CVD Workforce in Public hospitals to treat major CVD	Availability of essential medicines	Accessibility of Step Down Care	Robustness of secondary prevention	Integrated care comprehensiveness	Overall management of established CVD	Comprehensive National Registries	Effective system for developing and maintaining clinical guidelines	Workforce Planning	Supply Chain Resilience	Healthcare System Digital Readiness	Research, Development and Innovation	Overall score of system readiness
		Physical activity	Healthy Diet (Obesity)	Alcohol reduction	Tobacco-demand reduction																										
Australia	VH	VL	L	H	VH	M	VH	M	M	H	M	VH	VH	VH	H	VH	H	VH	H	VH	H	H	H	H	VH	VH	H	H	VH	VH	VH
Japan	VH	L	L	M	L	M	VH	M	VH	VH	VH	H	VH	VH	M	VH	H	M	H	VH	L	H	VL	M	VH	VH	M	VH	L	VH	H
Korea	VH	VL	M	L	H	M	H	M	VH	VH	VH	H	VH	VH	H	VH	H	H	VH	M	L	H	H	H	VH	VH	H	VH	VH	VH	VH
China	M	H	VL	M	L	M	VH	M	M	VH	M	H	M	H	M	H	H	H	L	H	VL	H	M	M	VH	H	L	H	H	M	H
Malaysia	M	VH	VL	H	M	L	VH	M	M	M	M	L	H	M	M	VH	M	H	M	H	VL	H	M	M	M	H	L	L	L	VL	L
Thailand	M	M	H	H	VH	M	H	H	H	H	H	H	VH	VH	M	VH	H	M	M	M	NA	VH	M	H	VH	H	L	L	H	VL	M
India	M	L	VL	M	H	L	H	L	M	M	M	M	H	H	VL	M	VL	M	L	M	VL	M	VL	L	H	VL	VL	VL	H	VL	L
Indonesia	M	VL	L	VH	VL	M	H	M	H	H	H	M	H	H	VL	H	L	L	L	H	NA	M	VL	L	VH	VH	L	M	VL	L	M
Vietnam	M	VL	VL	M	H	M	H	M	M	M	M	L	H	M	VL	H	M	L	M	M	NA	L	VL	L	VL	VH	L	L	M	L	L

Very low Low Moderate High Very high

REGIONAL RECOMMENDATIONS

OVERVIEW

Recommendation #1: Develop/strengthen a cohesive national CVD strategy

Recommendation #2: Strengthen emergency medical services to prevent premature deaths and disability

Recommendation #3: Strengthen screening and diagnostics guidelines and capacity for early detection, improved CVD risk management and secondary prevention

Recommendation #4: Prevent rehospitalization through improving cardiac rehabilitation services

Recommendation #5: Tackle rising CVD risk factors, unhealthy diets, obesity, and physical inactivity, through comprehensive multi-sectoral policy changes and awareness programs

Recommendation #6: Strengthen critical enablers of CVD care: monitoring and evaluation systems for health system capacity and performance that inform national policy and programs

- **Recommendation 6.1:** Establish effective monitoring and evaluation systems for health system capacity and performance that inform national policy and programs.
- **Recommendation 6.2:** Drive the development of digital infrastructure and CVD solution adoption by providing a clear digital roadmap.
- **Recommendation 6.3:** Tailor CVD strategies to local populations by advancing national research, development, and innovation capabilities.
- **Recommendation 6.4:** Strengthen CVD care capacity across the continuum through workforce development plan

RECOMMENDATION #1:
DEVELOP/STRENGTHEN A COHESIVE NATIONAL CVD STRATEGY AND POLICY

Tackling CVD requires a health-in-all approach as CVD is a complex and interlinked problem. A CVD policy is needed to solidify national goals in controlling CVD. A well-defined CVD strategy should be in place to operationalize the means to achieve the broader policy aim in a cohesive and coordinated way. Ideally such a CVD strategy should focus on (I) reducing preventable CVD-related deaths; (ii) reducing hospitalizations and re-hospitalizations from CVD and (iii) curbing the rise of new CVD patients. Supporting this approach requires clear governance, accountability, and investment in the financial and technical resources required.

RATIONALE

All nine countries have an NCD strategy that includes certain CVD policies, programs, or plans (Table 1). However, only three have dedicated CVD strategies. These were also formulated recently — Japan and Australia in 2020; South Korea in 2017. We evaluated countries' national health policies regarding essential components of an effective and cohesive CVD strategy across three dimensions: (i) specificity of the CVD strategy- whether CVD control objectives were vague or well thought through; whether the strategy or policy formulation process was (ii) inclusive in formulation- whether it addresses equity and includes vulnerable and marginalised as well as high risk groups, (iii) whether there is a coordinating mechanism to drive policy implementation both between national and subnational levels and inter-ministerially and (iv) whether there is adequate financing and complete coverage of patient needs across populations and across the entire patient pathway.

Six out of nine countries do not have CVD disease-specific targets (example for HF, stroke, ischaemic heart disease) or gender-focused approaches. Apart from Korea, none of the other countries have strong central-subnational coordination in formulating, implementing, and reviewing evidence to refine policies. Few have dedicated budgets for CVD. Only one country (Thailand) had a policy for diagnostics and early detection. While nearly all countries consulted cardiac experts in formulating policies for CVD under national NCD plans, only three consulted patient groups ***(Refer to Annex Table 1 for complete list of indicators evaluated for overall policy design).***

The lack of a cohesive CVD strategy means that aspects of controlling CVD may be neglected because of:

- Lack of a pathway to collecting and /or evaluating existing CVD data that feeds into a strategic action plan for CVD reduction reflexively, where the need is greatest— for instance, strengthening rural services for acute CVD services and cardiac rehabilitation, or improving screening uptake across communities.
- Competing priorities and shared funding allocated to prevention, treatment and health system strengthening towards delivery of services for other diseases that fall under NCDs.
- Missed opportunities in the patient pathway due to disconnected CVD strategies— in high income countries, policies for managing CVD in existing patients such as diagnostics, acute and chronic care are much stronger while preventive and screening policies are weaker; developing countries on the other hand have focused more on preventive efforts (albeit uncoordinated towards a CVD goal) than in effective management of CVD due to health system resource constraints.

APPROACH

The following table outlines actions needed within each of the four areas of the CVD strategy.

Leadership, accountability, and coordination mechanisms	
Empower a new or existing national body for leadership of CVD programs	**Empower a new or existing national body for leadership, coordination and oversight of the CVD policy and implementation with a clear chain of command.** This should include coordination between national and subnational leaders in setting targets, budgets, and implementing and reviewing plans.
Ensure vertical and horizontal integration in CVD policies and programs, across levels of government	**Build multi-level stakeholder engagement in the development of CVD policies :** • Implement the HiAP approach through inter-ministerial (including trade, finance, community, education, and health) coordination in setting goals and drawing up implementation plans. • Intra-regional (between central and subnational governments) consultations should include target setting for each region that builds on national targets and specific regional challenges must inform national policies. • Involve key stakeholders, including patient groups and cardiologists, in developing policies **Include the need to develop reflexive plans -** a research and development strategy along with a monitoring and evaluation (M&E) plan should be included in the overall CVD strategy to ensure there is adequate data to guide revisions in a reflexive manner.
CVD specificity	
Incorporate CVD policies tailored to the disease burden of the population	**Include population-specific CVD policies across the key stages of the patient journey:** prevention, screening, diagnosis, treatment; chronic, acute, rehabilitative, and palliative care. Prioritize the needs of high-risk populations.
Set disease-specific targets	**Define specific CVD disease targets** for heart failure, stroke, IHD and other pertinent country-specific CVDs.
Develop CVD-specific budgets	**Develop dedicated national CVD budgets** that include subnational financial support packages where needed, to ensure CVD remains a high priority in subnational planning and implementation
Inclusive and equitable policy formulation	
Ensure all stakeholders are consulted in policy formulation	**Involve CVD experts as well as patients in the policy formulation process.** The CVD strategy itself should be inclusive through comprehensively addressing CVD in vulnerable populations.

Inclusive and equitable policy formulation	
Address inequalities in coverage of CVD services	• **Ensure policies are designed to protect patients from catastrophic expenditure** on account of CVD emergencies and advanced CVDs such as complex IHD and advanced heart failure among others. • **Close the gaps in financial coverage of acute and chronic CVD disease management:** Evaluate whether high out-of-pocket expenses are originating within lower socioeconomic groups and consider financial inclusion strategies that may be more tailored to CVD, for instance providing a lower limit on co-payments for patients with chronic and complex cases with means testing. • **Allocate budgets to reduce inequalities in CVD service provisioning for rural areas:** Rural and less developed areas have reduced access to service provisioning, driving up waiting times for services in urban areas. This affects the affordability of timely intervention due to indirect costs such as travel and prolonged time away from work.
Improve on access to early diagnosis and treatment	• **Ensure financial coverage of essential screening and diagnostics:** Patients should also be able to access preventive screening and diagnostic procedures without having to pay out-of-pocket. Adequate financial coverage for CVD-specific screening and appropriate diagnostics in emergency settings can improve early detection. • **Cover complex treatment combinations in high-risk groups:** Financial coverage gaps for CVD services, even in systems that have comprehensive universal health coverage, result in OOP expenditure. For those who cannot afford to pay, this could also result in delayed treatment, lowered treatment adherence and missed treatment that can lower outcomes, particularly in high-risk groups such as those with multiple comorbidities. To ensure that treatment gaps are avoided, high-risk groups should be identified, and suitable financial coverage of complex treatment combinations should be designed and provided.
Strengthen system delivery	**Earmark financial resources to strengthen the wider health system aspects that affect service delivery:** High OOP expenditure can be a marker of inefficiencies or inadequate service provisioning. For instance, long wait times in public hospitals covered by UHC could force patients to pay more out of pocket for the same services at a private facility because of the need to be treated sooner. Earmarked budgets for CVD services such as digital adoption for home-based therapy can increase uptake of services while reducing both OOP expenditure and indirect expenses for patients.

CASE STUDIES

Countries can take reference from the United Kingdom's National Health Service Long Term Plan, which has clear goals and steps outlined to lower cardiovascular mortality.

United Kingdom has a National Health Service Long Term Plan (NHS LTP) that outlines the strategic direction and implementation plans for the healthcare system. Among which, cardiovascular disease is flagged within the plan for improvements aiming to increase early detection rates, treatment, and support for patients in primary care networks. In cardiovascular disease section, the plan has also outlined several key milestones specific to the disease and as well as implementation plans to achieve the goals set. Through the NHSLTP, cardiovascular disease has been highlighted as the single biggest area in which the NHS can save lives over the next decade

RECOMMENDATION #2:
STRENGTHEN EMERGENCY MEDICAL SERVICES TO PREVENT PREMATURE DEATHS AND DISABILITY

Timely access to acute care is closely linked to patient outcomes in the case of major cardiac events. Emergency services must be strengthened to ensure that acute care is accessible. They have the capacity to make acute care accessible and efficient in the context of CVD management. This includes bolstering early detection and rapid response systems, equipping emergency medical teams with specialized CVD training and equipment and fostering seamless coordination between pre-hospital and hospital care. By fortifying these aspects through a comprehensive policy and resource plan, countries can significantly reduce premature deaths and disabilities resulting from CVD emergencies.

RATIONALE

Lack of timely care is a predictor of poor outcomes in acute cardiovascular emergencies including stroke. Efficiently restoring coronary artery blood flow is pivotal in acute heart attack management. Swift initiation of percutaneous coronary intervention (PCI) within 12 hours of coronary occlusion significantly improves outcomes. The time taken for PCI, comprising onset-to-door time (OTD) and door-to-balloon time (DTB), is crucial. Patients with shorter DTB and OTD times demonstrate notably lower long-term mortality rates, emphasizing the importance of quick intervention. In stroke cases, timely thrombolytic therapy is even more vital, with a narrow therapeutic window. Utilizing ambulances shortens the OTD time for stroke patients, enhancing their likelihood of timely hospital arrival and thrombolytic therapy within the critical therapeutic window.

Given the above, it is important to investigate the quality of EMS services in the region to improve health outcomes for CVD patients.

We evaluated policies and plans related to emergency services in each of the nine countries (see Table 2). This includes the provision of CPR plans, early defibrillation provisional plans among others alongside the average EMS response time. While nearly all countries consulted cardiac experts in formulating policies for CVD.

Table 10: Policies and plans in place for emergency medical services by country.

Indicators	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Policies or plans for Emergency services specific to successful Chain of Survival	✓	✓	✓	✗	✓	✓	✓	✓	✗
Early access provisioning plans	✗	✓	✓	✓	✓	✓	✓	✓	✓
Early CPR provisioning plans	✓	✗	✓	✗	✗	✓	✗	✗	✗
Early defibrillation provisioning plans	NA	✓	✓	NA	✗	✓	✗	✓	✗
Early ACLS: Advanced Cardiac Life Support provisioning plans	✓	NA	✓	✓	✓	✓	✓	✓	NA
Early post-resuscitative care provisioning plans	✓	NA	✓	✓	✓	✗	✓	✓	✓
Acute Myocardial Infarction (AMI) networks set up	✓	✓	✗	✓	✗	✓	✓	✓	✓
Availability of diagnostic test: Cardiac troponin T and I isoforms	✓	✓	✗	✓	✗	NA	✓	✓	NA
Creatinine Kinase Myocardial isoenzyme (CK-MB)	NA	✓	✗	✓	✗	NA	✓	✓	NA
Electrocardiograph	✓	✓	✓	✓	✓	✓	✓	✓	✓
Response time	16.5 to 58.3 mins state-wide in Southern Australia	9.7 mins	4.2 mins (Seoul)	12.58 mins	30 to 40 mins	14.44 ± 4.86 min (Bangkok, 2021)	NA	24 mins	14.5 mins (Hanoi, 2018)
Onset-to-Door time (ideal <270 mins)	127.5 mins[94] (New South Wales)	68 mins[95] (Fukuoka and Kitakyushu areas)	100.38 mins[96] (Nation-wide)	372 mins[97] (Nation-wide)	95 mins[98] *(Based on a District Hospital)	129 mins[99] *(District Hospital)	76.8 mins[100] (North India)	NA	NA
Door-to-needle balloon time (ideal <30 mins)	85.30 mins[100] (Nation-wide)	65 mins[101] (Fukuoka and Kitakyushu areas)	40 mins[102] (Nation-wide)	169 mins[103] (Nation-wide)	49 mins[104] (Nation-wide)	75 mins[105] *(District Hospital)	72 mins[106] *(South Indian hospital)	25 mins[107] (Single Centre)	36 mins[108] (Nation-wide)
Door-to-balloon time (ideal <90 mins)	80 mins[109] *(a hospital in Perth)	80 mins[110]	60 mins[111] (Nation-wide)	134 mins[112] (Nation-wide)	110 mins[113] (Nation-wide)	117 mins[114]	71 mins[115]	97.79 mins[116] (Nation-wide)	65 mins[117] (Nation-wide)

**For countries where nation-wide data or state level data were unavailable, data based on papers that evaluated emergency medical services respond time in a single centre were used and may not be an accurate representation of the whole nation.*

Group 1 countries have well-established and standardized EMS supported by national policies and provisioning plans for pre-hospital emergency care systems. This provides an existing framework that can be improved upon to boost pre-hospital care. In contrast, while Group 2 and Group 3 countries have EMS in place, their coverage and capacity is inadequate which affects response time and subsequently impacts patient outcomes.

Additionally, CPR provisioning can be further improved in Group 1 countries to address the reported lack of confidence and training among the public in administering CPR.

APPROACH

Group 2 and Group 3 countries should first outline a national EMS policy and guidelines to standardize and boost pre-hospital rescue capacity.

Governments should then look into carrying out the following steps, to enhance the emergency response system on the ground in the short-term.

- Prioritize regular training and refresher workshops for first responders and public personnel to provide vital CPR and AED training at the community level, ensuring a swift and informed public response in emergencies.
- Establishing dispatch-assisted CPR guidelines to empower bystanders to take life-saving actions.
- Develop and/or strengthen a coordinated ambulance and referral system that meets the EMS guidelines for response times.
- Conduct periodic audits of emergency response capacity to improve performance.

These can be followed by more comprehensive measures including:

- Advance emergency department diagnostics and prognosis through evidence-backed methods, enhancing overall care quality.
- Introduce a Good Samaritan law in regions where absent, such as Indonesia, to encourage and protect individuals providing bystander CPR during crises.
- Integrate mapping of acute and emergency services to enhance resource allocation and coordination.
- Ensure equitable service coverage of emergency diagnostics and cath labs to address healthcare access disparities.
- Increase provisions for emergency ambulances to improve emergency response.
- Establish policies for public emergency ambulatory services at the local level and identify coordinating agencies and their roles to streamline coordination of hospital and ambulatory services, ultimately reducing response times.
- Include private health facilities in the pre-hospital rescue system and create provincial EMS centers to facilitate a more robust and coordinated EMS response. This involves careful planning, including strategic ambulance placement and provisioning at the district level, to ensure a well-organized and efficient emergency response system.

These measures will collectively strengthen the nation's emergency response capabilities and improve overall outcomes for out-of-hospital cardiac events.

RECOMMENDATION #3:
STRENGTHEN SCREENING AND DIAGNOSTICS GUIDELINES AND CAPACITY FOR EARLY DETECTION, IMPROVED CVD RISK MANAGEMENT AND SECONDARY PREVENTION

Screening and diagnostics are crucial for the early detection and prevention of cardiovascular disease (CVD). Early screening for CVD risk factors such as high blood pressure (hypertension), high cholesterol (hyperlipidaemia), diabetes and elevated blood sugar allows timely interventions and targeted prevention. Diagnostics provide accurate insights into disease severity, guiding personalized care and optimizing resource allocation. Prioritizing screening and diagnostics proactively address CVD, promoting a healthier population.

RATIONALE

We assessed policies, guidelines and programs for screening and diagnostics in each of the nine countries (see Table 3 below). The following components were evaluated: strength of primary care screening policies & guidelines, strength of screening programs, comprehensiveness of diagnostics policies and diagnostic capacity.

Table 11: Policies and programs in place for screening and diagnostics by country: scorecard

Indicator	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Strength of screening policies & guidelines	M	VH	VH	M	M	H	M	H	M
Strength of screening programs	H	VH	VH	VH	M	H	M	H	M
Overall strength of screening	M	VH	VH	M	M	H	M	H	M
Comprehensiveness of diagnostics policies	VH	H	H	H	L	H	M	M	L
Diagnostic capacity	VH	VH	VH	M	H	VH	H	H	H
Overall strength of diagnostics	VH	VH	VH	H	M	VH	H	H	M

Very low Low Moderate High Very high

Screening for CVD primary risk factors at primary and community health centers is inadequate due to multiple factors:

1. **Shortage of front-line workers for screening and follow-up:** In four out of nine countries (India, Indonesia, Malaysia, and Vietnam) there is a significant shortage of community health workers and allied health workers available to carry out screenings. India and Malaysia rely on volunteer community workers who are often not compensated proportionally. This shortage also reduces the capacity for follow up appointments and monitoring of high-risk individuals, which leads to later

detection of CVD. Later stage CVD puts a greater financial burden on the healthcare system and leads to worse health outcomes for the patient.

2 **Lack of comprehensive screening guidelines for CVD risk factors:** With six out of nine countries carrying out screening as part of their NCD strategy with no CVD-specific guidelines, a significant proportion of at-risk populations are going undetected.

- In both Group 2 and Group 3 countries, primary level screening for *hyperlipidaemia is not included in guidelines*.
- In India and Vietnam, there are no guidelines for secondary prevention which consequently excludes screening for secondary prevention.

3 **CVD diagnostics guidelines are not up to date:** CVD diagnostics guidelines in Group 2 and Group 3 countries are not fully aligned with global best practices. Furthermore, the lack of regional/national CVD research and data means that screening and diagnostic guidelines are not contextualized to local populations, especially in Group 2 and Group 3 countries.

- Along with heart function tests, novel cardiac biomarkers such as natriuretic peptides (NT-proBNP or BNP) and high-sensitivity troponin are included in the European and US guidelines for the timely diagnosis and prognosis of symptomatic patients for heart failure and acute coronary syndrome respectively.[119,120] However, in Group 2 (with the exception of Thailand) and Group 3 countries, adoption of these biomarkers has been limited to the private sector due to the high out-of-pocket costs associated with these biomarkers as well as the limited awareness amongst clinicians and diagnostic technicians on the use of these biomarkers.

4 **Lack of diagnostic capacity:** A lack of trained diagnostics technicians as well as limited diagnostic infrastructure leads to delays in and failures to timely detection of CVD. In Group 2 and Group 3 countries, diagnostic capacity is both inadequate and maldistributed, being concentrated in urban centers.

APPROACH

- Develop and/or strengthen national CVD-risk screening and diagnostics guidelines to be both comprehensive and up to date with global best practices.
  - Screening guidelines and capacity for hyperlipidaemia, a key CVD risk factor, needs to be established and strengthened at the primary care level for India, China, Vietnam, Thailand, and Malaysia.
  - Guidelines for screening for secondary prevention need to be established in India and Vietnam.
  - Evaluate the cost-effectiveness and use of evidence-backed novel cardiac biomarkers such as natriuretic peptide (NT-proBNP or BNP) and high-sensitivity troponin for earlier detection of CVDs and timely intervention for primary and secondary screening, diagnosis, and evaluation of discharge readiness to and improve patient outcomes, reduce readmissions, and shorten hospital stays.
- Invest in building more diagnostic capacity at the primary care-level, especially in rural and other underserved areas, especially in Group 2 and Group 3 countries.
- National screening strategies should also incorporate and/or strengthen CVD health promotion and awareness programs.

CASE STUDIES

Reviews of diagnostic policy can help to create a centralised directory with updated information and incorporation of new cost-saving diagnostic tests.

1.

Utilizing NT-proBNP as a primary diagnostic tool for congestive heart failure in primary care in Portugal significantly reduced costs by minimizing medical visits, hospitalizations, and echocardiograms with point-of-care settings offering higher savings due to decreased visits.

In Portugal, a study on biomarkers at point-of-care settings (PoC) showed that the use of NT-proBNP as a primary diagnostic tool for CHF diagnosis in primary care could result in considerable costs savings for the public health system[1].

It was estimated to generate annualized savings of EUR 935,657 and EUR 2,982,443 in the Lab and PoC setting, respectively. Estimated cost savings were due to the need for fewer medical visits, hospitalizations, and echocardiograms (ECHO). The lab and PoC settings led to similar reductions in hospitalizations (14.4%) and ECHO (27%). Reduction in medical visits was higher in the PoC setting (38% compared to 2.5%), resulting in higher savings compared to the lab setting.[121]

2.

India's National Essential Diagnostics List provides a directory of information available for diagnostic tests used in detection of common diseases.

India's National Essential Diagnostics List outlines the basic set of tests for detection and diagnostics for common diseases including NCDs that should be available across the care continuum – Health and Wellness Centers, Primary Health Centers, Community Health Centers, Sub-district, and District Hospitals.[122]

3.

United Kingdom's recent review of their diagnostic policy resulted in the clear demarcation of acute and elective diagnostic tests along with new models of care.

The UK's 2023 diagnostic policy reviewed service delivery models to include the separation of acute and elective diagnostics, establishment of community diagnostic hubs (CDHs), new pathways with virtual consultations and access to expert advice and guidance, easy and safe access to blood tests, i.e., phlebotomy in the community, use of new diagnostic technologies supporting near-patient testing and infection control measures.

RECOMMENDATION #4:
PREVENT REHOSPITALIZATION THROUGH IMPROVING CARDIAC REHABILITATION SERVICES

Robust cardiac rehabilitation (CR) capacity is required to enable continuity of care outside clinical settings in the community or at home. CR is a medically supervised program to help patients who have experienced heart failure, heart attacks, strokes, or undergone cardiac surgery. It includes exercise counselling and training, adherence to treatment, education for heart-healthy living which includes risk reduction (such as smoking cessation) and stress reduction counselling. The program works best with a team of multidisciplinary specialists and family or social support.

Non-adherence to cardiovascular medications is widespread in Asia Pacific countries, with treatment non-adherence in the region as high as 70%.[123] CR is crucial to increase medication adherence and improve lifestyle change in current CVD patients.[124]

RATIONALE

Cardiac rehabilitation is key to cost-effective reduction of CVD-related deaths and disability:

- CR can reduce death and disability by 20%[125] and reduce the risk of a subsequent heart attack in AMI patients by 28%.[126]
- Hospital and home-based CR programs reduce the associated costs from readmissions compared to having no CR program at all.[127]
- Home-based CR programs cost less[128] for patients due to lowered travel, loss of work, consultation costs and lowered barriers particularly for caregivers, patients with reduced mobility, rural and indigenous groups.[129]
- Moving hospital-based care to communities may reduce the cost while improving accessibility and can be provided in tandem with home-based care for patients who have greater difficulty in accessing community-based CR programs.[130]

We assessed policies, guidelines and programs for monitoring and rehabilitation post-discharge in each of the 9 countries (see Table 4 below). The following components were evaluated: national guidelines for CVD management in primary care, patient group involvement, adherence monitoring, treatment adjustments practiced, counselling at primary care level, uniform availability, and inclusion of CR program components such as exercise, counselling, and psychosocial support, as well as adequate CR coverage and utilization.

Table 12: Policies and programs in place for screening and diagnostics by country: scorecard

Indicator	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Strength of monitoring and rehabilitation policies, guidelines, and programs	VH	M	H	H	H	M	M	L	L

Very low | Low | Moderate | High | Very high

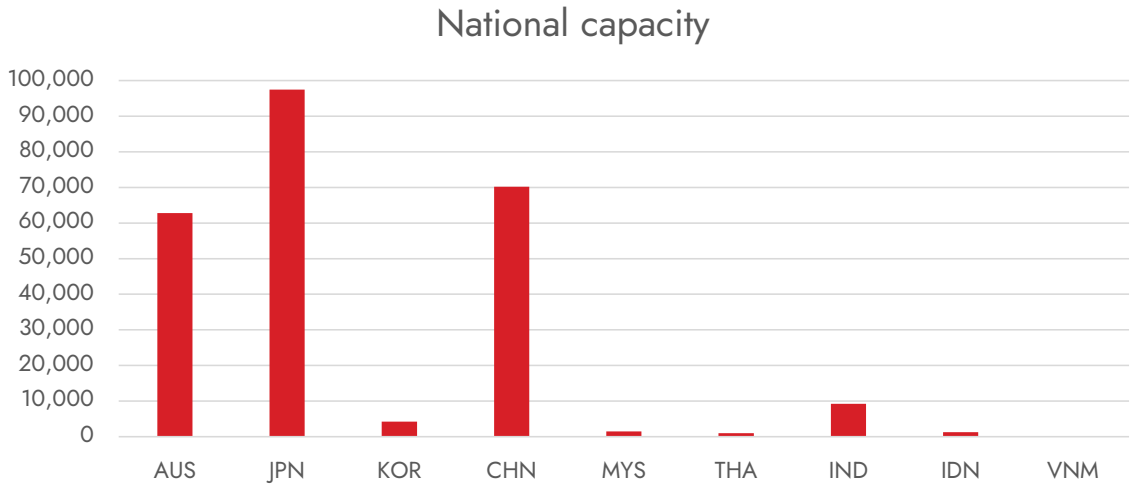
Group 1 countries were found to have more comprehensive programs and guidelines as well as higher CR capacity than Group 2 and Group 3 countries.

Japan scores lower than its other Group 1 counterparts due to lower coverage and utilization of CR programs.

There are gaps in provision and delivery of CR programs in a majority of the nine countries.

Japan, China, and Australia have higher CR capacity while capacity is markedly low in the remaining six countries, with Vietnam having no CR programs prior to 2019 (Figure 7).

*Figure 8: National cardiac rehabilitation capacity: capacity for eight out of nine APAC countries in 2019. *Vietnam had no CR programs in 2019.*[131]



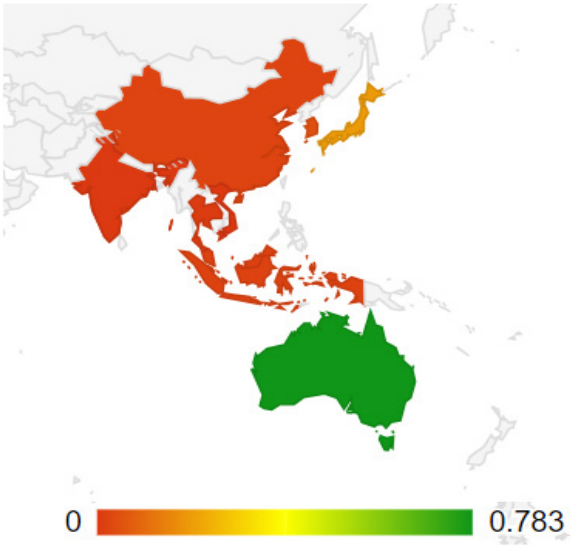
Urban-rural disparities in service availability are found throughout the region. 71.6% of all CR programs globally are delivered in urban locations while 14.3% and 12.4% of CR programs are in suburban and rural areas respectively. Within the nine countries in consideration.

Rising demand far outpaces capacity except for Australia.

Figures 9A and B show that despite Japan and Korea's high overall CR program numbers, **only Australia's current CR capacity closely matches its need at 78%**. For instance, there is 1 CR spot for every 360 IHD patients in India, 1 CR spot for every five patients in Japan, and 1 spot for every IHD patient in Australia. **India, Thailand and Vietnam's CR programs cover less than 0.5%** of new IHD cases and urgently require an increase in CR programs in relation to the burden of disease (Figure 8B). Vietnam had no national CR programs in 2019 and is thus excluded here.

Figure 9A: CR density per country in 2019: How available CR programs are based on the potential need (number of new IHD cases, 2019. (.)*[132]

CR Coverage relative to need, by country



CR utilization is suboptimal except for Australia.

In Australia, program utilization is 100%, indicating high participation rates in highly available programs, while India and Japan's CR programs are highly underutilized (Figure 9). In Indonesia, CR programs are also completely utilized, but given the lower density relative to disease burden, it is likely that more patients in need of CR are unable to participate due to lack of program capacity. In Malaysia, there are more patients participating than programs can accommodate.

System-level barriers to cardiac rehabilitation delivery.

Across all countries, a lack of strong patient referral post discharge and financial resources are the two major barriers that should be addressed in increasing capacity (Figure 10). The shortage of human resources for health also impacts service delivery in higher income countries, particularly in Japan, Australia, China, and Malaysia[135] and especially in rural areas.[136]

- Policies are needed to address capacity taking into consideration the relative needs based on disease burden and existing barriers to delivery to ensure there is sufficient density of programs per given number of CVD patients in the country to serve rising needs.
- Policies should address lower utilization rates which may be due to low awareness of programs or challenges in accessing these programs due to distance, costs, mobility, or psychosocial challenges.

Figure 9B: CR Coverage: Shows density in terms of capacity- percentage of new IHD patients who can be provided rehabilitation at any point in time.[133]

Proportion of new IHD patients who can be provided CR at any time

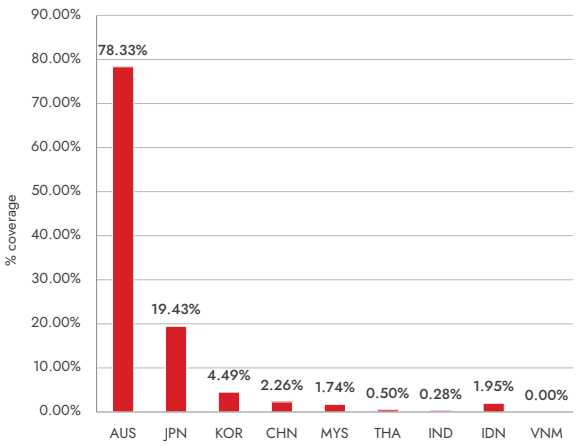


*Figure 10: Annual CR utilization per CR program in each country: potential utilization versus actual utilization (*Vietnam had no CR programs at the point of this study in 2019, *Thailand data was unavailable).*[134]

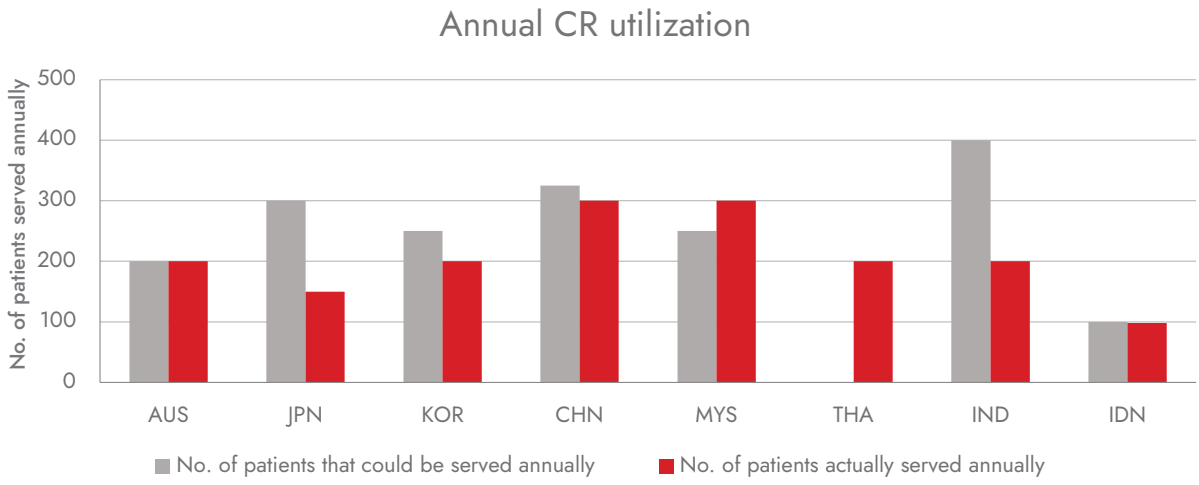
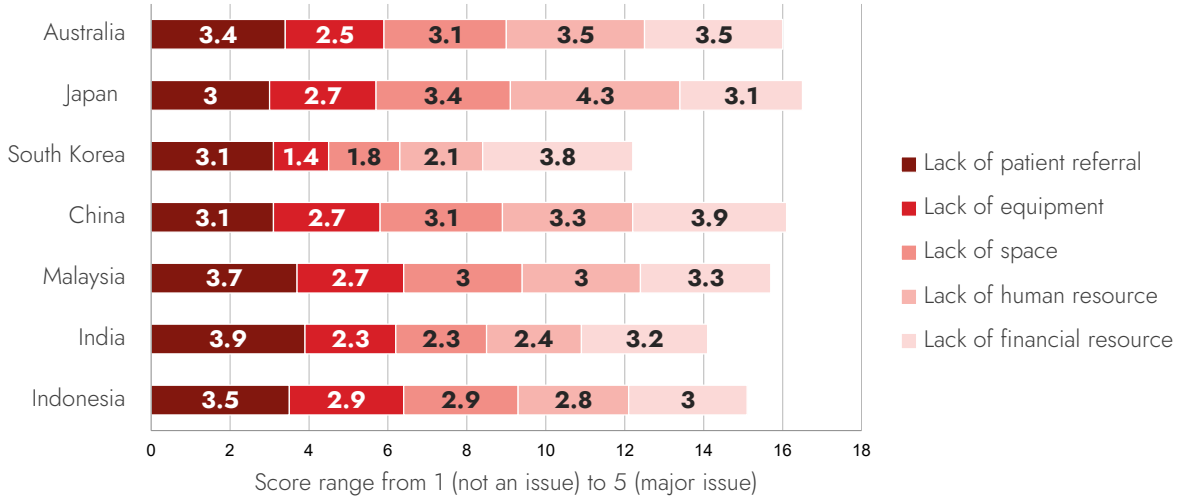


Figure 11: Barriers to cardiac rehabilitation delivery by country.[137]



APPROACH

Greater public funding and the right linkage to care in delivering rehabilitation outside of clinical centers are central to the effectiveness of rehabilitation, particularly in rural areas where accessing central services may be more physically challenging, time-consuming.

1. Set national policies for provision of sufficient cardiac rehabilitation programs:
   - Set comprehensive national guidelines for cardiac rehabilitation (CR) programs, covering standard components, optimal durations, clear referral pathways, standardized accreditation, and regular guideline updates.
   - Establish policies for step-down care in secondary and tertiary hospitals, ensuring strong referral systems for seamless transitions to secondary prevention throughout the rehabilitation period.
   - Allocate sufficient funding for affordable and accessible public rehabilitation programs, particularly in rural area.

2. Enhance awareness and support for rehabilitation by fostering patient support groups within the cardiac community, promoting program adherence, uptake, and completion.
3. Improve rehabilitation accessibility through tele-rehabilitation, incentivizing healthcare providers to leverage digital technologies for home-based CR and ensuring multidisciplinary care and family involvement.
4. Utilize community health workers or upskilled nurses to deliver rehabilitation programs within communities and homes.
5. Allocate financial resources to public health systems for building CR capacity, especially in rural areas, covering workforce, referral systems, and digital solutions.
6. Ensure financial affordability of CR programs for patients by including them in reimbursable health services or providing subsidies, particularly in systems relying heavily on out-of-pocket payments.

The incorporation of remote monitoring technology in cardiac rehabilitation programs to facilitate home-based cardiac interventions has resulted in significant improvements in controlment of risk factors, reduced incidence of cardiac events and reduced unscheduled admissions.

CASE STUDIES

1.

The Irish Heart and Stroke patient organization has created a cardiac rehabilitation program that utilizes remote monitoring technology, lifestyle modification and online group activity sessions resulting in significant improvements in risk factors among patients.[138]

Croí MySláinte, developed by the Irish Heart and Stroke patient organization Croí and accredited by the European Association of Preventive Cardiology (EAPC) Centre, addressed the urgent need for a structured, comprehensive cardiac rehabilitation (CR) program during the COVID-19 pandemic.
Led by an experienced interdisciplinary team, the 12-week program emphasized lifestyle modification, medical risk factor management, and psychosocial and behavioural support. Patients were provided with tools like Fitbit and a home blood pressure monitor, engaging in online group exercise sessions and educational workshops.

Over a 3-month period, significant improvements were observed in patients meeting guideline-recommended targets for physical activity, blood pressure management, low-density lipoprotein cholesterol, weight reduction, and adherence to the Mediterranean diet. Moreover, anxiety and depression levels were notably reduced by more than 50%. Remarkably, these positive outcomes were sustained at the 6-month follow-up, affirming the program's enduring impact on patients' cardiovascular health and overall well-being.

CASE STUDIES

2.

Use of a smartphone-facilitated home-based cardiac rehabilitation model has reduced incidence of cardiac events and unscheduled readmissions.[139]

In Beijing, the Chinese PLA General Hospital rolled out a smartphone-facilitated home-based cardiac rehabilitation (HBCR) model for coronary heart disease patients after successful revascularization.

Patients in the HBCR group received educational material weekly and individualized exercise prescription monthly. Outcomes improved for patients under HBCR with nearly six-fold reduction in incidence of major adverse cardiac events (1.5% vs 8.9% vs control group) and reduced unscheduled readmissions (9.7% vs 23.0%).

3.

Community-based CR program offered by national referral center for cardiovascular medicine.[140]

In Singapore, the National Heart Centre offers a structured community-based CR programme for CVD patients referred to by hospitals.

Patients in the community CR programme are supervised by a multi-disciplinary team of physiotherapists, dieticians, and smoking cessation counsellors. The programme consisted of one-to-one diet consultation sessions, and supervised exercise sessions. Patients under the community CR program had a significant lowering of their low-density lipoprotein (LDL) levels (-2.2 to 2.4mmol/L), while the control group saw a rise in their LDL levels (+2.2 to 2.4mmol/L). Enrolled patients also saw greater improvements in their total cholesterol (-0.3 vs +0.2mmol/L), fasting blood glucose (-0.5 vs +o.3mmol/L), systolic blood pressure (-3.2 vs +5 mmHg), and diastolic blood pressure (-2.6 vs +2.8mmHg).

RECOMMENDATION #5:
TACKLE RISING CVD RISK FACTORS, UNHEALTHY DIETS, OBESITY, AND PHYSICAL INACTIVITY, THROUGH COMPREHENSIVE MULTI-SECTORAL POLICY CHANGES AND AWARENESS PROGRAMS

CVD risk factors are intertwined with different aspects of life—healthcare, education, urban planning, and food systems. A HIAP approach is crucial for stemming the rise in CVD risk factors through the implementation of strong, interconnected policy changes across various sectors. This multi-sectoral approach ensures comprehensive and coordinated interventions, maximizing policy impact. These policy changes in tandem with widespread awareness programs will be effective in educating the population, promoting healthier lifestyles, and lowering their CVD risks.

RATIONALE

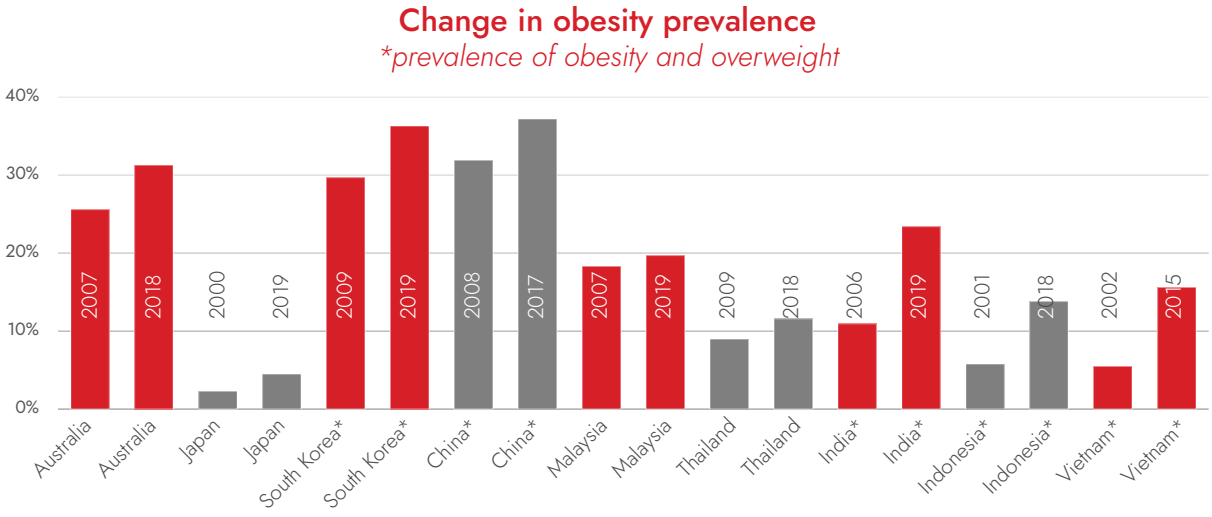
Each of the nine countries have set national targets for the reduction of behavioural NCD and CVD risk factors such as physical inactivity, unhealthy diets, tobacco, and alcohol consumption. Unhealthy diets and obesity as well as physical inactivity were areas where most countries failed to meet their targets (see Table 13). Epidemiological analysis (see Chapter 2) also shows that high blood pressure and dietary risks are the top two contributing factors to CVD, both of which are closely linked to each other.

Table 13: Progress in meeting physical activity and healthy diet targets and the effectiveness of CVD programs implemented

Indicator	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Progress in meeting physical activity targets	VL	L	VL	H	VH	M	L	VL	VL
Progress in meeting healthy diet and obesity targets	L	L	M	VL	VL	H	VL	L	VL
Effectiveness of CVD awareness programs	M	M	M	M	L	M	L	M	M

Very low | Low | Moderate | High | Very high

Figure 12: Change in obesity levels over the last two decades by country



Eight out of nine countries failed to meet their healthy diet and/or obesity targets.

Obesity increases CVD-related death and disability both directly and indirectly, significantly heightening the risk of metabolic diseases and cardiovascular issues.[141] Except for Thailand which maintained its prevalence over the study period, eight of the nine countries failed to meet their obesity targets. Childhood obesity has more than doubled in Thailand, Vietnam, Malaysia, and China.[142,143,144,145] India, China, and Indonesia rank first, second and fourth in the Obesity World Atlas's predictions for prevalence of childhood obesity in 2030.

Table 14: Predicted obese children by 2030 across countries in India, China, and Indonesia

Country	Predicted obese children by 2030[146]
China	61,987,920
India	27,481,141
Indonesia	9,076,416

Between 2009 to 2019, Asian countries showed the highest increase in sales of ultra-processed foods (UPF): at the top of the list was India (7.8%), Pakistan (6.3%) and Indonesia (4.5%) whereas there was little growth in places like Germany (0%) and the United States (0.4%) (Figure 12).[147] UPFs are linked to weight gain and increased risk of cardiovascular diseases.[148,149]

Seven out of nine countries failed to meet their national physical activity targets.

Consistent physical activity not only diminishes the risk of premature death from cardiovascular disease (CVD) but also acts as a preventive measure against diabetes, aids in weight management, and lowers hypertension - all of which are individual risk factors for CVD. Those who are less active and less fit face a 30-50 % higher risk of developing high blood pressure.[150]

Physical inactivity stands as a notable risk factor for CVD, akin to smoking and high blood pressure in its impact. Its widespread prevalence significantly contributes to mortality rates. Regular physical activity has been proven to play a protective role against initial cardiac episodes, aid in patients' recovery from heart surgeries, and reduce the risk of recurring cardiac events.[151]

Seven out of nine countries also scored poorly in meeting their physical activity targets, with Korea and Australia seeing a decline in national physical activity levels. Women's physical activity levels remain significantly below men's in Indonesia, Japan, and Malaysia.

APPROACH

A multisectoral approach is required to implement the following:

- Improve access to fruits and vegetables and improve access to varied food groups.
- Strengthen health promotion activities and obesity screening and management programs to tackle overweight and obesity in children at the primary care & community level.
    - Restrict marketing of unhealthy foods to children in line with WHO guideliness.[152]

- Reformulate processed foods and snacks to regulate amounts of salt, sugar, and fats to be within healthy limits.
  - Introduce ingredient-limited taxation to promote industry reformulation and to modify consumer behaviour.
- Launch region-based dietary recommendations and consumer culture-change campaigns with colour-coded labelling to encourage adoption of healthier foods.
- Create sensitization and awareness initiatives on the links of obesity and physical inactivity to cardiovascular health.
  - Targeted awareness and physical activity programs are required to improve physical inactivity levels for women in the region.

CASE STUDIES: HEALTHY DIETS

Partnerships between government and the private sector are crucial to address dietary intake of sodium, saturated fats, and sugar through methods such as reformulation, food advertisement restrictions and taxation of sugar-sweetened beverages.

1.

Reformulating of processed food in conjunction with industry stakeholders helps to reduce sodium, saturated fats, and sugar consumption by citizens.

Australia's Partnership Reformulation Program between public, food industry, and government to reformulate processed food (e.g., biscuits, soups, bread) based on specific targets on levels of sodium, saturated fats, and sugar. 1 Saturated fat in participating products decreased by 0.5%, with a reduction of 0.1g per person/day (0.2%) in saturated fat intake of the total 36.3g consumed daily.[153]

2.

The presence of a sugar-tax in Mexico has reduced sugar consumption among citizens.

Mexico's sugar-sweetened tax showed greatest reduction in consumption among the poor. It has been estimated that the Mexican SSB tax would prevent 239,900 cases of obesity over ten years.[154,155,156]

3.

Restrictions in food marketing policies can lead to decreased saturated fat and sodium intake and reduce purchase of sugar-sweetened products.

Chile's Law on Food Advertising empowers the Chilean MOH to monitor and enforce food marketing policy specifically for children. Chile targets advertisement restricts food advertisement on children's channels and programs. This includes a total TV advertising blackout between 6am to 10pm.

Chile categorizes food according to a nutrient profile (e.g., saturated fat, free sugar, carbohydrates).2 There has been a 73% drop in Chilean children's exposure to TV ads, a decline in purchased sugar by 10.2%, and a decline in saturated fat and sodium content by 3.9-4.7%.[157]

4.

Taxation of sugar-sweetened beverages can reduce sugar consumption while generating income for the ministry.

The Centre for Indonesia's Strategic Development Initiatives (CISDI) projected that a 20% increase in sugar-sweetened beverage prices would reduce its consumption by 17.5% on average. Based on estimates from the Finance Ministry, taxing sugar-sweetened beverages between Rp 1,500 and Rp 2,500 per litre could generate state revenue figures of an estimated Rp 2.7 trillion to Rp 6.25 trillion.[158]

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CASE STUDIES: PHYSICAL ACTIVITY

A national physical activity plan helps to identify and implement methods such as mobile-based programs to improve physical activity among citizens.

1.

The presence of a national physical activity plan can help to coordinate nation-wide efforts to improve physical activity rates.

Scotland's Active Scotland Delivery Plan, published in 2018, identifies a wide range of actions across all sectors with the overall aim of reducing physical inactivity in adults and teenagers by 15% by 2030. As of 2021, 69% of adults met the guidelines for moderate or vigorous physical activity (MVPA) which is a significant improvement from the rates recorded previously. Such a plan helps to coordinate efforts to improve physical activity rates.[159,160]

2.

Mobile-based physical activity programs provide a way to effectively improve physical activity of participants.

In Singapore, the National step challenge provides rewards and incentives for achieving a target step count. Through providing step trackers to participants, this allowed recording of daily physical activity and paired with step count goals and financial rewards. Such a mobile-based physical activity campaign has proven to be a success and improved the physical activity trend of participants.[161]

RECOMMENDATION #6:
STRENGTHEN CRITICAL ENABLERS OF CVD CARE: MONITORING AND EVALUATION SYSTEMS FOR HEALTH SYSTEM CAPACITY AND PERFORMANCE THAT INFORM NATIONAL POLICY AND PROGRAMS

Tackling CVD in the Asia-Pacific requires a well-provisioned health system to effectively respond to increasingly multi-faceted challenges. Implementing robust monitoring and evaluation (M&E) practices, addressing current and future workforce capacity, and cultivating digital health transformation and innovation are crucial systemic enablers to enhance overall CVD response. Governments need to prioritize building its health system capacity across the continuity of CVD care.

Policy tools to boost system readiness for CVD:

Recommendation #6.1: Establish comprehensive and effective monitoring and evaluation systems for auditing health system capacity and performance

Recommendation #6.2: Drive the development of digital infrastructure and CVD solution adoption by providing a clear digital roadmap

Recommendation #6.3: Improving Research, Development, and Innovation for CVD through development of a roadmap to guide and coordinate efforts among stakeholders

Recommendation #6.4: Strengthening CVD care capacity across the continuum through workforce development plans

Recommendation #6.1:
Establish effective monitoring and evaluation systems for health system capacity and performance that informs national policy and programs

Regular monitoring & evaluation (M&E) practices are crucial for Ministries of Health to track availability and distribution of national healthcare resources, including manpower, diagnostic equipment and tests, CVD drugs, and infrastructure. Robust M&E systems also aid in auditing clinical adherence to guidelines, treatment outcomes of CVD procedures, and overall performance of the health system.

RATIONALE

Monitoring feedback and gaps in public health system's responses allows policymakers and authorities to reallocate healthcare resources and address CVD health needs more impactfully. However, many countries lack comprehensive M&E mechanisms for monitoring various aspects of healthcare resources and infrastructure

Eight out of nine Asia-Pacific countries maintain national registries for major CVDs, however, not all are updated frequently

Table 15: Availability of national registries established for major CVDs across the nine Asia-Pacific countries.

	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
National registries established for CVD	✓	✓	✓	✓	✓	✓	✓	✓	✗
Stroke	✓	✓	✓	✓	✗	✓	✓	✓	✗
Ischemic heart disease	✓	✓	✓	✓	✗	N/A	✓	✓	✗
Percutaneous coronary intervention	✓	✓	✓	✓	✓	✓	✓	✓	✗
Acute coronary syndrome	✓	✓	✓	✓	✓	✓	✗	✓	✗
Heart Failure	✓	✓	✓	✓	✓	✓	✓	✓	✗

All other APAC countries except Vietnam maintain national registries for major CVDs including heart failure, stroke, and coronary heart diseases. However, registries in India, Indonesia, Malaysia, and Thailand lack good data governance in ensuring that information is up-to-date and comprehensive. Data collection practices are non-standardized and selective, as Japan's registries require manual entry and focuses on large hospitals, while data collected in Malaysia is strictly voluntary. China, South Korea, and Thailand also face difficulties in integrating hospital CVD data with electronic medical records systems.

Monitoring and evaluation across the care continuum remains a challenge, especially for Group 2 and Group 3 countries

From health promotion activities to patient rehabilitation and monitoring, most Group 2 and Group 3 countries face challenges in both the collection and effective use of data to monitor and evaluate programs. There is limited information on national CVD budgets and expenditure.

Data on the performance of NCD/CVD reduction programs is infrequently updated - for certain target metrics such as the number of patients on CVD therapy, data could not be found in India, China, and Vietnam. Ensuring patient adherence to CVD treatment is important to reduce risks of recurrent cardiac events and rehospitalizations, however, there is little to no information available in Group 2 and Group 3 countries.

The same goes for screening and diagnostics services, where the lack of M&E leads to a failure to detect CVD in its early stages which has serious health and financial impacts.

Most APAC countries are also missing effective M&E systems to audit and standardize treatment across healthcare institutions. Monitoring and standardizing physician adherence to clinical treatments helps reduce variations in treatment and improve quality of clinical care through evidence-based practices. In Indonesia, Japan, South Korea, and Vietnam, authorities face difficulties in monitoring clinician adherence to clinical CVD practices. Private hospitals and healthcare facilities in India and Thailand lack proper audits to track clinical adherence. Many primary care physicians also lack awareness and understanding of the latest clinical guidelines.

Most APAC countries do not have a robust system to regularly monitor healthcare workforce, drugs, or diagnostic supplies.

The lack of information has often resulted in a shortage or maldistribution of healthcare resources geographically, resulting in differences in treatment outcomes.

APPROACH

Countries' ministry of health should develop a detailed roadmap to progressively incorporate M&E practices for assessing its CVD care performance and health system enablers.

Ministries of Health should develop clear policies and prioritize outlining its M&E targets and conducting periodic surveys across different care settings.

- **Develop and incorporate targets for health system capacity & performance** under national strategy. Indicators should encompass various aspects of the care continuum (e.g., health promotion, screening & diagnosis, emergency & acute care, step-down care), and can be broken down further for state, provincial, or district level-reporting in Asia Pacific countries.
- **Conduct surveys to assess availability** of CVD manpower, drugs and diagnostic equipment, and physician adherence to clinical standard guidelines in public and private health facilities. At the initial stages, health authorities can select a sample of hospitals or healthcare institutions for auditing healthcare capacity.
- **Adapt and simplify guidelines for physician adherence to clinical guidelines** across different geographical contexts. Health authorities can simplify guidelines through flowcharts in rural areas and increase adherence of healthcare professionals to clinical guidelines.
- **Mandate Continuous Medical Education (CME) refresher courses** on latest CVD care guidelines for physicians. Integrating these courses into the curriculum will help to raise physician awareness of the latest guidelines and standardize CVD care across the continuum.

Investments into developing national CVD registries, training of experts in M&E, and forming a regulatory division overseeing audits will be necessary to develop a robust M&E system in the long-term.

- **Set up national CVD registries and establish linkages with electronic medical records.** Policymakers and health authorities in Asia Pacific countries should set up an interoperable digital platform accessible by public and private healthcare providers at the regional and national level. The platform would allow integration of digital records with CVD registry data and enable hospitals to report CVD patient data to registries more timely and comprehensively.
- **Monitor treatment adherence by tracking of clinical data.** At the institutional level, policymakers and public health coordinators can review prescription data, physician surveys medical record reviews, and consolidate insights at a centralized database to guide data-driven policy change.
- **Regulatory division for conducting audits** on health capacity & programs. A regulatory authority can conduct annual audits of health capacity, including availability of CVD drugs and diagnostic equipment, healthcare staff, adherence to treatment guidelines, variations in CVD care, and distribution of health services across rural-urban areas.
- **Training of healthcare administrators** specialized in M&E practices. Professional association and health authorities can introduce training courses to equip these administrators with public health program design, data collection and analytics skills. These skills will help these experts to track CVD care capacity of the health system and make recommendations to reallocate resources for improving CVD response.

Recommendation #6.2:
Strengthening CVD care capacity across the continuum through workforce development plans

Country governments must establish a comprehensive national workforce strategy to strengthen health promotion, screening & diagnostic, emergency rescue and acute care services across the CVD care continuum. Recruitment and retention strategies such as professional support programs, mentorships, and scholarships with service bonds would attract and train healthcare workers such as cardiologists, community physicians, nurses, and diagnostic technicians to supplement CVD services.

Table 16: Presence of training program for specialized CVD management, policies or programs for successful workforce retention addressing CVD workforce distribution

	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Training program for specialized CVD management	✓	✓	✓	✗	✓	72%	53%	✓	✓
Policies or programs for successful workforce retention	✗	✗	N/A	✗	✗	N/A	✗	✗	✗
Policies or programs addressing CVD workforce distribution	✗	✗	✗	✗	✗	N/A	✗	✗	✗

RATIONALE

The nine Asia-Pacific countries' ability to tackle the growing CVD burden is challenged by a shortage of skilled health workforce capacity across critical aspects of the CVD care continuum.

- Most countries report a lack of CVD specialists (e.g., cardiologists, cardiac surgeons) in the public sector and rural areas.
- At the primary healthcare level, there were inadequate community physicians and other healthcare professionals available in India, Malaysia, and Vietnam.
- There was a shortage of frontline workers to carry out screening in India, Malaysia, Indonesia, and Vietnam
- Moreover, Australia, China, India, and Vietnam face a shortage of skilled diagnostic technicians to operate diagnostic imaging services.

In addition to workforce shortages, every country's CVD care capacity is also challenged by skilled workforce maldistribution across the urban-rural divide, low public health workforce retention, or both. Cardiologists and specialists in China, Japan, South Korea, Thailand, and Vietnam were mostly concentrated in cities and metropolitan areas, resulting in a shortage of professionals in rural health services. Retention of specialists in public healthcare was found to be low in India and Malaysia due to the high work burden in the public sector and better incentives and career progression opportunities in private practice.

APPROACH

The Ministry of Health and professional organizations should develop a coordinated, multi-stakeholder national workforce policy outlining various plans to strengthen, recruit, train, and retain healthcare workforce to address CVD needs.

To address immediate workforce shortages and inequitable distribution, short and medium-term strategies can focus on:

- **Mandatory rotations of healthcare professionals to rural areas** for temporary stints. Medical authorities can consider incorporating compulsory attachments of physicians and other professionals to rural areas under their Continuing Medical Education scheme.
  - **Professional support & career progression pathway programs** for training more CVD specialists, diagnostic technicians, and other healthcare professionals, including better financial incentives, mentorships & career progression in rural health services.
  - Increasing private sector stewardship in rural health services can help shift more CVD care capacity towards remote areas, especially in India and Indonesia with a significant rural population that lacks access to CVD care. Financial incentives can be provided for private sector workers to work in villages.
- **Incorporate task-shifting/ task-sharing protocols** to reduce burden on physicians. Administrative tasks can be allocated to other administrative workers, while other health professionals like nurses can take on case managerial roles for performing diagnostic tests, prescribing medication, and follow-up with referrals for CVD patients.
- **Use of existing telemedicine services to provide CVD care in rural or remote areas.**

In the long-term, the government can focus on rural recruitment strategies such as service bonds for scholarships and deploying telemedicine services for remote services and support.

- **Scholarships with service bonds** in rural areas can target aspiring residents from villages, sponsoring their training and qualifications in exchange for working in remote areas. Recruiting future professionals from their home environment will help them ease into local healthcare settings quicker and increase their chances of staying.
- **Strengthening telemedicine infrastructure** across levels of care will form linkages between experienced CVD specialists in tertiary institutions, and physicians from grassroots clinics and community health centres. Rural physicians can access remote mentorship and guidance from experienced cardiologists on CVD-related knowledge. Additionally, rural residents can access telecardiology services through their doctors when necessary.

Recommendation #6.3:
Drive the development of digital infrastructure and CVD solution adoption by providing a clear digital roadmap and increase upskilling of healthcare staff in digital literacy.

Empower a new or existing governing body to lead and develop a roadmap for the development and adoption of digital solutions to enhance CVD care. This leadership body must coordinate with the national digital health authority as well as public and private stakeholders to develop a roadmap and create an investment plan for developing digital infrastructure that supports CVD preventive and care services. The roadmap should also address other critical enablers including the upskilling of healthcare workers to improve their digital literacy.

Table 17: Availability of various digital health tools, guidelines, and enablers

	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
National guidelines for usage & training of workforce in digital tools (e.g., EMRs, telehealth services, wearables)	✓	✗	✓	✓	✓	✓	✓	✗	✗
National strategy for integrating digital health in national CVD care	✓	✓	✓	✓	✗	✓	✓	✓	✗
Extent of adoption of the following digital health tools:									
Electronic medical records (EMR) adoption	H	M	H	H	M	M	L	L	L
Telehealth and other remote patient monitoring solutions	H	M	M	M	L	H	L	L	H
Mobile/patient self-monitoring	M	M	M	M	L	L	L	M	L

H = High; M = Moderate; L = Low

RATIONALE

The high variability of countries' socio-economic environments, culture, and natural environment has led to vast differences in digital healthcare adoption in the region. While most countries have guidelines for digital health tools alongside a national strategy for integrating the use of digital health into CVD care, uptake of digital health has been mixed across healthcare settings. Group 1 countries have more extensive digital adoption of health services with electronic medical records being the most common as most hospitals utilizing electronic medical records. However, in Indonesia, Vietnam, and Malaysia the use of telehealth services in home care and self-monitoring of CVD patients has not yet been fully tapped due to the limitations indicated below.

The COVID-19 pandemic has driven adoption of digital health services in most countries. However, barriers impeding its uptake can be linked back to differences across countries:

- In Group 1 countries, barriers such as interoperability across health information systems in countries pose challenges resulting in inefficient deployment of resources.[162]
- For Group 2 countries, the lack of expertise and skills to fully utilize health technologies has limited widespread adoption.
- The lack of digital infrastructure to support implementation and lack of digital literacy pose a challenge in Group 3 countries.

To overcome the multifactorial barriers, a range of interventions specific to the country is required.[163]

APPROACH

Socioeconomic differences between the countries surveyed necessitate group-wise strategies towards building a roadmap for the adoption of digital solutions for CVD. Nevertheless, improving healthcare workers' literacy in CVD-based digital health services, and further development of mobile-health interventions, telecardiology, patient monitoring, and integrated electronic health records are integral to fostering a digital CV service ecosystem across all nine Asia Pacific countries.

- **Identify digital health services for integration into CVD care to develop a hybrid digital cardiology service model in patient care**.
  - A multi-stakeholder taskforce comprising national digital health agency, professional associations, and large hospital groups can engage public and private sector healthcare providers to discuss CVD-related digital health interventions and approaches to identify them. This would require a needs assessment of digital health services and foundational ICT infrastructure that can support digital cardiology services.
  - In Group 3 countries, governments can identify digital cardiology services that require less digital-intensive ICT infrastructures to support their implementation. This may include cost effective interventions such as mobile health (Mhealth) usage for improving patient management of CVD risk factors. For example, simple periodic reminders can be sent through text from community health workers to patients to take their medication.
  - By developing a hybrid digital model for CVD patient management, this incorporates the use of health technology devices into existing community health networks to reduce workload and extend reach. Low-cost wearable devices can be distributed to patients at high-risk of CVD for monitoring, and early detection of hypertension or atrial fibrillation.
- **Develop digital roadmaps to boost digital innovation and implement hybrid model for digital cardiology**.
  - Across all nine Asia Pacific countries, the roadmap would allow for clear resource distribution and coordinate efforts across the various stakeholders to implement digital cardiology services progressively.
  - In Group 1 countries and China, the roadmap can outline steps to improve interoperability of electronic health records across different healthcare providers and allow CVD patient data to be transmitted across various referral levels (e.g., cardiac unit, primary care center). Governments can also explore further integrating EMRs with CVD registries for better surveillance and monitoring of patient cardiovascular outcomes.
  - These digital roadmaps will assist Group 2 and 3 countries lacking the foundational infrastructure to invest long-term resources in building their ICT capabilities for supporting more digital-intensive cardiology services such as telemedicine and remote patient monitoring.
  - The digital roadmap can also outline guidelines to healthcare providers for them to implement digital cardiology services in line with current regulations such as data privacy and consumer protection.
- **Introduce operational guidelines for digital cardiology services and training courses to upskill healthcare workers competencies**
  - In Group 3 countries and Japan, setting clear guidelines for operating digital health services, including

mobile-health (MHealth) services to manage CVD risk factors and medication adherence, telecardiology, and remote monitoring, will help clinicians, nurses, and other healthcare practitioners to adapt to the use of remote technologies and boost adoption of digital health tools.

- The guidelines also provide an evaluation standard for healthcare professionals to collect relevant clinical data to track CVD patient progress, and the impact of digital health interventions.
- Professional associations and training institutions can create upskilling courses to train healthcare workers in the use of telecardiology, mobile health (MHealth) interventions, and wearable devices used to monitor CVD patient health. Increased digital literacy would help encourage utilization of cardiovascular digital interventions across healthcare institutions.

Recommendation #6.4:
Tailor CVD strategies to local populations by advancing national research, development, and innovation capabilities

A national policy for research, development and innovation will prioritize research on CVD in citizens in the national agenda. It will also facilitate both national-level leadership and collaboration through an appointed body. Along with promoting knowledge sharing and fostering research capabilities within the medical community, this national policy will be supported through an allocated national budget for setting up research funding systems to support CVD research and outline a roadmap for implementing the national research strategy.

RATIONALE

CVD mortality rates vary significantly across Asian countries, for instance, the crude rate of stroke mortality in Vietnam is approximately double that of Malaysia.[164] Diet-related disparities impact CVD DALYs, with China having the highest diet-related DALYs at 299 per 100,000 population in comparison to other Central and Eastern Asia countries.[165] The prevalence of hypertension in India is 25.8%, contrasting with 48.1% in the United States in 2021.[166] Despite these variations in the prevalence of CVD types and related outcomes, most countries in the region continue to use clinical guidelines that are large developed for US or European populations. Genetic differences along with the fact that many APAC countries are undergoing an epidemiological transition further emphasise the need for government investment in research, tailored guidelines, and treatments.

Table 18: RDI projects and initiatives in place across the nine countries

	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
National health policy addresses research for CVD	✓	✓	✓	✗	✗	✗	✗	✗	✗
National-level body appointed to lead research in CVD	✓	✓	✗	✗	✗	✗	✗	✗	✗
Promotion of RDI projects that offer a response to existing CV health needs	✓	✓	✓	✓	✗	✗	✗	NA	✓
Presence of multidisciplinary working groups to identify needs	✓	✓	✓	✓	✓	✓	✗	✓	NA
RDI plans contain areas of research and innovation in cardiovascular health based on patient outcomes	✓	✓	✗	✗	✗	✗	✗	✗	✗
Roadmap for RDI for CVD with indicators that are monitored and reviewed periodically	✗	✓	NA	✗	✗	✗	✗	✗	✗
Training programs for healthcare professionals to conduct CVD-related research and innovation	✓	✓	✓	✓	✗	✗	✗	NA	✓
Development of initiatives to empower citizens for digital-based self-care in cardiovascular health	✓	NA	✓	✗	✗	✗	✗	✗	✗

Despite efforts to establish multidisciplinary research groups, R&D policies and roadmaps are largely absent in most countries, except Japan.

The absence of R&D policies and roadmaps hampers the promotion of RDI projects addressing CVD health needs, particularly in LMICs. Additionally, while governments recognize the necessity for training programs to enhance digital literacy and research skills among healthcare workers, the implementation of innovative technology lags due to the lack of a systematic plan.

APPROACH

The following is a stepwise approach for the development of a strategic national policy to boost local RDI for CVD.

- **Set national RDI Policy to prioritize cardiovascular health research efforts based on current needs and impact.**
  - Appoint an existing or new national body to drive research and development
  - Identify and define specific areas in CVD services based on patient outcomes and population needs.

- Ensure RDI efforts target real-world health concerns and enhance individuals' well-being.

- **Create research funding streams to promote innovation and development**.
  - National governments should allocate a yearly health budget for CVD-based research according to the continuum of care for a CVD patient. This includes health promotion & prevention of CVD risk factors, screening and diagnosis, emergency & acute care services, step-down care, and secondary prevention.
  - Prioritize and incentivize local and frugal innovation.

- **Adopt a strategic approach towards strengthening RDI in the country**.
  - Develop a roadmap considering current patient needs and ongoing monitoring.
  - Prioritize professional training, citizen empowerment, and equitable resource distribution.
  - Ensure research efforts are not concentrated in urban centers. Extend support and resources to rural communities for inclusive cardiovascular research
  - Utilize the roadmap as a guiding framework to advance cardiovascular healthcare and enhance population well-being.

- **Implement monitoring indicators**.
  - Include quantitative and qualitative indicators for tracking progress and effectiveness.
  - Regularly monitor and review these metrics for continuous assessment and adjustments.

- **Develop tailored training programs for healthcare professionals to contribute to RDI**.
  - Equip healthcare providers with necessary research and innovation skills.
  - Enable professionals to contribute actively to improving cardiovascular health through evidence-based practices that help guide them in utilizing new technology and adhere to updated guidelines.

- **Empower Citizens for Digital-based Self-Care**.
  - Establish educational initiatives and support systems for citizens.
  - Encourage self-care, healthy lifestyle choices, and early detection of cardiovascular risk factors.
  - Foster an informed and engaged population to reduce the burden of CVD through promoting the uptake of healthier lifestyle and increasing awareness of CVD.

FUTURE CONSIDERATIONS

APPLYING A GENDERED LENS

Applying a gendered lens has been overlooked due to the view that women have a comparatively lower incidence of CVD to men and have a perceived lower risk of pre-disposing behavioural factors.

The need for a gendered lens is not to prioritize the needs of one gender over the other, rather it is to improve the effectiveness of preventive and curative measures of CVD control by being more targeted, as CVD is caused by factors common to men and women, but also those specific to women such as menopause, poly-cystic ovary syndrome (PCOS), medical conditions during pregnancy (including hypertension, gestational diabetes, preterm delivery) and previous breast cancer treatment.[167,168] Underlying wider determinants that can influence risk, diagnosis and outcomes of prevention and treatment can also vary for women and men in different sociocultural contexts[169].

There is a lack of awareness: in Singapore, CVD kills six times more women than cancer[170]. Global studies have shown women and health professionals lack awareness on the gender differences in CVD. Women are underrepresented in heart disease research. Women make up only about 30% of participants in research studies and trials[171]. Diagnosing and treating women are often delayed as CVD presents differently in women compared to men. As a result, the delay results in poor outcomes for female patients.

There is no gendered approach to CVD control in the countries included in this report, although some countries have guidelines for treating CVD in women. There is a dearth of gender disaggregated information on diagnosis, treatment and prevention to clearly evaluate where efforts can be strengthened as well as the absence of research on women's heart health.

Countries should adopt a gendered lens in planning policies and programs across the patient continuum for both men and women to ensure they address gender-based differences that may differ from country to country. Countries should also aim to increase awareness among women about their risks for CVD, and health professionals on recognizing these risks early, prioritize research on women's heart disease and invest in routine, high quality, gender-disaggregated data across the continuum to understand how CVD is manifesting in men and women differently and to identify key areas for targeted urgent action.

ADDRESSING DATA GAPS AND CREATING PUBLICLY AVAILABLE CVD CARE PATHWAY SPECIFIC INFORMATION

While official health promotion and prevention targets, programs and plans are available, there is a paucity of data both officially and through research outputs on the percentage coverage of eligible populations and participation rates for preventive programs.

Granular data for primary health centre data is unavailable for services rendered towards primary prevention for all countries, such as the percentage of patients who've had weight and height or waist circumference, alcohol consumption, smoking status, those who have been referred to smoking cessation services, who've had fasting plasma glucose levels, lipid testing or BP measured within a stipulated time frame and global risk assessments recorded on their charts. Whether this data is unavailable publicly or whether these metrics are not being measured is unclear.

Across the curative pathway, service indicators are not available for most countries through government data.

Diagnostic workforce capacity by subtype (sonographers, ECG technicians, radiologic technologists, phlebotomists etc.) is unavailable for all except Japan, SK and Australia. Trained CVD healthcare staff by subtypes (surgeons, interventional cardiologists, cardiac nurses, rehab specialists and imaging technologists) unavailable in all countries. Step down care data such as how much of the population is covered at the local and national levels is unavailable.

Information for EMS planning, acute care data such as re-hospitalization rates, cardiac rehabilitation capacity, utilization and resource needs were sourced through academic research articles where available. This highlights the need for national level data monitoring to include such a list for evaluating CVD initiatives across the care continuum. Countries should collect and organize data pertaining to the CVD care continuum at national and subnational levels to aid in local administration decision-making towards improving and optimizing services and for long-term planning of resources.

APPENDIX

FINDINGS: CVD STRATEGY

Only Australia, Japan, and South Korea have a dedicated CVD policy. All countries have an NCD policy, with most including some action on CVD within the broader NCD strategy.

Several indicators were considered in evaluating if there was a comprehensive CVD strategy in each country under four dimension:

I CVD specificity

II Inclusivity and equitable policy formulation

III Coordinating mechanisms for implementation

IV CVD financing

(I) CVD specificity

CVD specificity looks at whether countries have a CVD-focused strategy or policy in place to frame and direct implementation towards specific CVD goals.

Table 18: RDI projects and initiatives in place across the nine countries

National health policy addresses the following key CVD policy components	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM	*No. of countries with this component*
					(I) CVD Specificity					
NCD policy	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Dedicated CVD policy	✓	✓	✓	✗	✗	✗	✗	✗	✗	*3*
CVD reduction targets	✗	✓	✓	✗	✓	✓	✗	✗	✗	*4*
Disease-specific goals	✓	✗	✗	✗	✓	✗	✗	✗	✓	*3*
Comprehensiveness of upstream targets	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
strategy on screening for CVD risk factors	✗	✓	✓	✗	✓	✓	✗	✗	✗	*4*
strategy on diagnostics for CVD	✗	✗	✗	✗	✗	✓	✗	✗	✗	*1*
objectives or strategies for management of acute and chronic CVD	✓	✓	✓	✗	✗	✗	✗	✓	✗	*4*
Objectives or strategies for secondary prevention	✓	✓	✓	✗	✗	✗	✗	✗	✗	*3*
Objectives or strategies for promoting CVD research	✓	✓	✓	✗	✗	✗	✗	✗	✗	*3*
Objectives or strategies for promoting CVD research	*7*	*8*	*8*	*2*	*5*	*5*	*2*	*3*	*3*	*–*

- **Nearly all countries have CVD reduction targets** such as reducing NCDs or specifically CVD mortality rates by a certain percentage except for Indonesia.
- **All countries have targets for more than half of all upstream risk factors** such as physical activity, obesity, hypertension, hyperlipidaemia, alcohol consumption, smoking, salt intake and healthy diets.
- **Except for India, all countries have a policy for maintaining healthcare quality,** including when delivering CVD services.

However, only three out of nine Asia-Pacific countries have a dedicated CVD strategy (Australia, Japan, and South Korea).

- Australia's goal is to reduce CVD mortality but does not mention a quantifiable target while both **Japan and South Korea** lack disease-specific goals.
- Although they do not have a CVD-specific strategy, **Malaysia and Vietnam have**

disease-specific goals for CVD such as reduction in mortality for heart failure (HF), stroke or ischemic heart disease (IHD).

More than half of all countries lack a CVD-specific screening strategy — Australia, China, India, Indonesia, and Vietnam.

Thailand is the only country with a CVD diagnostics policy, while there was no data on whether Japan and South Korea had one. A diagnostics policy ensures that access to diagnostics and adequate provisioning is planned for in terms of manpower, infrastructure, and consumables. It is fundamental to equitable delivery of screening and timely diagnosis of CVD events, yet it is the most commonly absent component across the region.

(II) Inclusivity and equitable policy formulation

Countries were evaluated for inclusivity whether policy formulations were informed in an inclusive manner through engaging both health provider and patient perspectives and whether the policies designed left out vulnerable populations (Table 19).

Table 19: Equitable and inclusive design of CVD policies

	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Policies addressing equitable access to care to CVD	✓	✓	✓	✓	✓	✓	✓	✓	✓
Programmes addressing equitable CVD care	✓	✓	✓	✓	✓	✗	✓	✓	✓
Any inequities in care access across gender/ socioeconomic groups	✗	✗	✓	✓	✓	✓	✓	✓	✓
Programs for monitoring inequities of public health services	✓	✓	✓	✓	✗	✗	✗	✗	✗
Policies and programs for children,women, PWD, LGBTQIA+, marginalised or indigenous groups	✓	✓	✓	✓	✓	✗	✓	✓	✓
Review of UHC programs to access innovative therapies	✗	✓	✓	✓	✗	✓	✗	✓	✓

- While **all countries consulted cardiac experts** in formulating policies, **only three (Australia, Japan, and Indonesia) consulted patient groups** in the process.
- Nearly all countries have policies to address care inequities. Eight out of nine countries included vulnerable or marginalized groups to some extent.
- **Six** out of nine **had gender or socioeconomic gaps** in their approaches, except for Australia, Japan, and South Korea.

- **Four countries - Australia, Japan, South Korea, and China had programs for monitoring inequities** of public health services.
- Eight countries include some vulnerable groups, but none include a comprehensive range (children, women, PWD, marginalized and indigenous groups).
- Five countries- Japan, China, Thailand, Indonesia, and Vietnam routinely reviewed universal health coverage programs to access innovative therapies.

(III) Leadership, accountability, and coordination

Countries were evaluated for strategies outlining leadership at the national level, coordination of strategy between national and subnational, between ministries, dedicated CVD programs and M&E programs dedicated to CVD.

Table 20: Assessment of national health policies for Leadership, accountability, and coordination for implementation.

National health policy addresses the following key CVD policy components	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM	*No. of countries with this component*
(III) Leadership, accountability, and coordination										
Dedicated national NCD program	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Dedicated national CVD program	✓	✓	✓	✓	✗	✗	✗	✗	✓	*5*
Joint National and regional CVD coordination mechanisms	✗	✗	✓	✗	✗	✗	✗	✗	✗	*1*
Multi-ministry cooperation	✓	✓	✓	✓	✓	✓	✓	✓	✗	*8*
National CVD M&E program	✓	✓	✗	✓	✗	✗	✓	✓	✗	*5*
National NCD M&E program	✓	✓	✗	✓	✓	✓	✓	✓	✓	*8*
Score for completeness of CVD strategy components (score out of 10)	*5*	*5*	*4*	*5*	*4*	*3*	*3*	*4*	*3*	*–*

- **Dedicated NCD and CVD programs:** all nine countries have dedicated NCD programs. Australia and South Korea have national CVD programs that are tailored to regional contexts. Vietnam and China implement national programs as is while Japan's prefectures plan to tailor national CVD programs. **Malaysia, India, Indonesia, and Thailand do not have dedicated CVD programs.**
- **Multi-ministerial coordination: Japan, South Korea and Australia have a multi-ministry mechanism to address**

CVDs. Malaysia, Indonesia, India, Thailand, and China have multi ministerial task forces to address NCDs in general. **Vietnam has no multi ministerial or equivalent coordination outside of the ministries of health and finance.**

- **Coordination between state and subnational governments:** there are no task forces or coordinating bodies specific to CVD across eight countries that comprise national and subnational representatives to plan subnational budgets, prioritize CVD uniformly and define 'local' targets towards the national CVD strategy objectives.
- **India, South Korea, Vietnam, and Thailand** do not have a national CVD monitoring and evaluation program established although they do have a NCD monitoring program.

(IV) CVD Financing

CVD policy implementation requires political commitment in spending adequately to provide sufficient health services for CVD prevention and management. Financial risk protection against catastrophic expenditure is necessary to ensure patients have early and regular access to treatment without pushing them into poverty. Studies have shown that the risk of catastrophic spending increases with increased out-of-pocket (OOP) expenditure, particularly in low-income countries.[172] While OOPs themselves may not be an indicator of catastrophic OOP expenditure on its own as this may be from co-payments and private expenditure among higher income groups, it is important to identify what is contributing to the high OOPs and the proportion of OOPs paid by lower-income groups. Financial hardship should be minimized by closing gaps in universal health coverage and ensuring there is adequate government spending on improving health service provision.

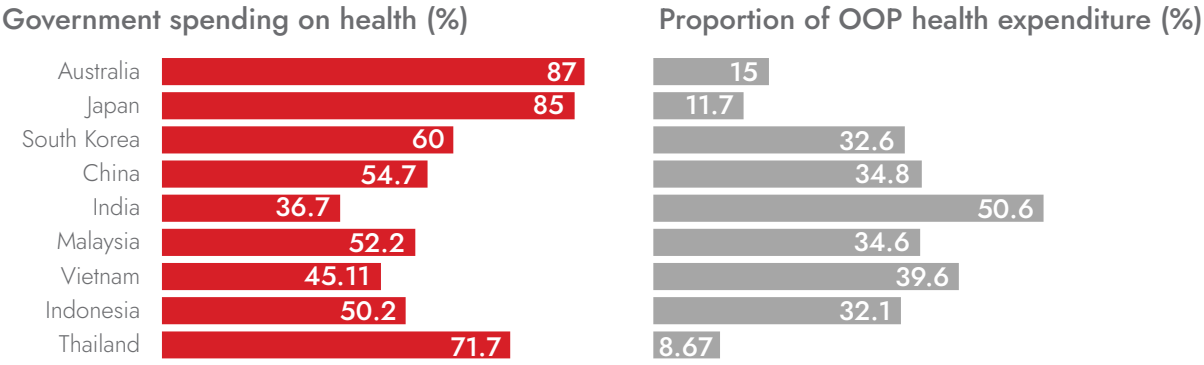
Table 21: Assessment of national health policies for CVD financing components

National health policy addresses the following key CVD policy components	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM	*No. of countries with this component*
(IV) CVD Financing										
Dedicated budget to NCD programs	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Dedicated budget to CVD programs	✓	✓	✓	✓	✗	✗	✗	✗	✓	*5*
Universal coverage for screening for CVD	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Universal coverage for diagnostic tests and imaging for CVDs are financially covered	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Universal coverage for CVD Essential medicines	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*

National health policy addresses the following key CVD policy components	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM	*No. of countries with this component*
Universal coverage for acute care for CVDs	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Universal coverage for hospitalization related to CVDs	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Universal coverage for outpatient consultation and follow-ups for CVDs	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Financing schemes for high-risk groups	✓	✓	✓	✗	✗	✓	✗	✗	✗	*4*
Score for completeness of CVD strategy components (score out of 10)	*9*	*9*	*9*	*7*	*7*	*8*	*7*	*7*	*8*	–

Among the nine countries, those with the highest government spending are also where there is the lowest out-of-pocket (OOP) expenditure:

Figure 13: Government spending on health and out-of-pocket expenditure (OOP) by country

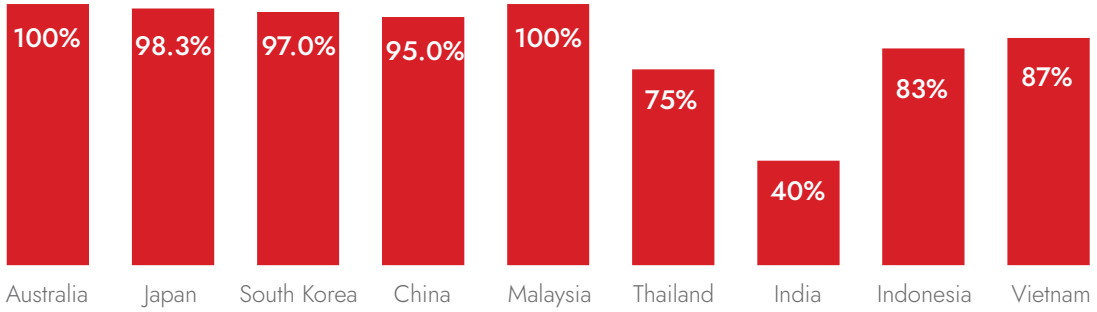


OOP and Government spending % per country may not be within the same year. Data from 2019-2023

- **Australia, Japan, and Thailand have the highest percentage of government spending on health** among all nine countries and the **lowest OOP proportion. All three are well below 20%** (Figure 13).
- The remaining **six countries** have OOP expenditure that is **12-30% higher than the recommended limit.**
- **From the nine countries, India** has the **lowest government spending on health** and the **highest OOP expenditure. OOPs in India exceed government spending** on health (Figure 13)

Eight out of nine countries have some form of social health insurance. Of these, eight of the nine countries have high population coverage under the UHC. India's population coverage is low in comparison.

Figure 14: Proportion of population covered by UHC[173], by country



- **Six out of nine countries have high OOP expenditure.** (Figure 13).
- Of the six, **South Korea, China, Indonesia, and Vietnam have high population coverage for their respective UHC models (Figure 14) but have gaps in financial coverage of services that lead to high OOPs.**
- All countries have a dedicated budget for NCD programs. However, only **Australia, Japan, South Korea, China, and Vietnam have dedicated budgets for CVD programs.**
- Coverage for screening services for upstream risk factors is included under universal health coverage, particularly for those in lower socioeconomic groups. However, in Thailand, screening for dyslipidaemia is not included.
- **Coverage of diagnostics:** all countries cover diagnostic tests and imaging through UHC schemes; basic essential CVD medicines are also covered. Acute care and hospitalization are covered by universal health coverage schemes, however there are gaps in coverage for particular or specific diagnostic tests in varying degrees – majority of physicians across the countries noted that more than 50% of patients had access to transthoracic echocardiography with natriuretic peptide tests conducted on only 25% of patients presented to the emergency department with suspected heart failure[174]. Across countries, UHC coverage for diagnostic tests varies - for instance in Thailand some medical devices such as heart valves are not covered by national health insurance.
- **Coverage of procedure:** Procedures are covered under UHC to varying degrees across countries. In Indonesia, angioplasty and coronary artery bypass surgery are covered in both public and private hospitals accredited under the national health insurance scheme and in Vietnam, open-heart surgery is covered under their national social health insurance.
- **Rural and urban differences in health service financing** to keep costs low or manage resources can lead to barriers in accessing services, for instance, in Indonesia, the national cardiac center in Java is provided a larger reimbursement budget compared to hospitals in other regions, and subsequently, services that are covered by insurance in these hospitals are limited, and patients could choose to do the procedure but at their own expense or travel to the national cardiac center where more complex procedures are fully covered. In China, rural OOP co-payments are 35% compared to only 10-20% in urban areas. Conversely, also in China, rural areas cover stroke and congenital heart defects but not in urban areas. In Thailand, health facilities covered under national health insurance are fewer in rural areas.

Findings: Health Promotion & Prevention

The development of policies and their implementation for CVD Health Promotion and Prevention is uneven for each of the nine countries.

Table 22: Progress of development and implementation of risk factor reduction programs across the nine countries

	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Effectiveness of risk factor reduction programs:									
Physical activity	VL	L	VL	H	VH	M	L	VL	VL
Healthy Diet & Obesity	L	L	M	VL	L	H	VL	L	VL
Alcohol Reduction	H	M	L	M	H	H	M	VH	M
Tobacco-demand reduction	VH	L	H	L	M	VH	H	L	H
Effectiveness of CVD awareness programs	M	M	M	M	L	M	L	M	M

Very low Low Moderate High Very high

Group 1 and Group 3 countries have had the least success in achieving their national physical activity targets.

While Australia has included physical activity guidelines in its national health policy, it lacks a coordinated national plan to implement them effectively. Only 15% of adults aged 18 - 64 met physical activity levels stated in national guidelines.[175]

Similarly, in Japan, physical activity programs are conducted at the prefecture level, lacking national coordination, and resulting in uneven progress.[176] A targeted physical activity improvement program, especially for women, is necessary. In South Korea, aerobic physical activity levels in 2020 dropped below 2018 levels and have further declined during the pandemic.[177]

China has comprehensive national physical activity programs, with moderate uptake at 37% in 2016-2020 and expected to increase by 2025.[178] Malaysia's mass media campaigns have been a contributor in the country exceeding its physical activity targets.

Vietnam lacks national guidelines for physical activity, and both India and Indonesia have failed to meet physical activity targets due to uneven and ad-hoc program implementation.[179,180]

Eight out of nine countries scored poorly on their healthy diet targets, with Thailand achieving moderate success improving healthy diet uptake.

Thailand has achieved its goal of 'no increase in obesity' by enforcing policies to control unhealthy ingredients and promote healthier food choices.[181] However, progress in reducing sodium intake, curbing harmful alcohol use, and managing diabetes has slowed.[182,183]

Obesity, especially in children, continues to rise across many of these countries. In Vietnam, rates have tripled over the last decade while nearly 20% of schoolchildren in China are overweight or obese.[184,185] In India, 20 out of 28 Indian states have seen an increase in childhood obesity.[186]

Salt consumption in China, India, Japan, Malaysia, and Vietnam exceeds the World Health Organization's recommended daily intake of 5 grams.[187,188,189,190] While South Korea successfully met sodium reduction targets ahead of schedule, India lacks comprehensive national policies to address excessive salt consumption. China, Malaysia, and Indonesia have also failed to meet their sugar reduction targets.[191,192]

Australia, Thailand, Malaysia, and Indonesia have done well in meeting their alcohol consumption reduction targets.

Alcohol remains a high contributor to CVD risk in South Korea as alcohol consumption control policies are currently inadequate – 82.62% of men exceeded the recommended daily alcohol consumption in 2018.[193] Policies and programs also need to be strengthened in Japan, India, and China where there is patchy enforcement and implementation – especially in China where there are no alcohol reduction targets.

Australia has successfully addressed harmful consumption of alcohol with a 1.1% decline per year in the overall per capita consumption of pure alcohol over the last decade.[194]

Tobacco consumption targets have not been met in Japan, Indonesia, and China

Smoking levels in Japan have declined over the past decade, however, progress has plateaued – current policies and programs are inadequate.[195] China has several **national laws and regulations for reducing tobacco usage, but no overarching comprehensive tobacco control law**.[196] Similarly, Indonesia lacks comprehensive tobacco control policies and robust implementation.[197]

In South Korea, Thailand, and Australia, effective programs have heightened awareness about tobacco risks, successfully reducing tobacco use. While Malaysia and India possess adequate policies for tobacco reduction, curbing illicit tobacco remains a challenge.[198,199] On a positive note, both India and Vietnam are on track to meet their smoking reduction targets.[200,201] However, vaping, and other smokeless tobacco forms are gaining traction in the region and require immediate attention, particularly in Group 2 and Group 3 countries.

CVD awareness initiatives has been inadequate across the nine countries.

Findings: Screening & Diagnosis

With six out of nine countries carrying out screening as part of their NCD strategy with limited or no CVD-specific guidelines, a significant proportion of at-risk populations are going undetected.

Table 23: Srength of screening and diagnostic policies across the nine countries

	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Strength of screening policies & guidelines	M	VH	VH	M	M	H	M	H	M
Strength of screening programs	H	VH	VH	VH	M	H	M	H	M
Overall strength of screening	M	VH	VH	M	M	H	M	H	M
Comprehensiveness of diagnostics policies	VH	H	H	H	L	H	M	M	L
Diagnostic capacity	VH	VH	VH	M	H	VH	H	H	H
Overall strength of diagnostics	VH	VH	VH	H	M	VH	H	H	M

Very low Low Moderate High Very high

Lack of comprehensive national screening policies and guidelines for CVD risk factors in a majority of the nine countries

- Japan, South Korea, and Thailand have stronger national policies and guidelines for CVD risk factors. In Australia, while there are clinical guidelines in place for screening, there is no national policy. Coordination is lacking at a central level with each state taking their own approach when it comes to implementation. National health policies in China and Vietnam too do not address a systematic screening program for CVDs.
- In both Group 2 and Group 3 countries, primary level screening for **dyslipidaemia is not included in guidelines.**
- In India and Vietnam, there are **no guidelines for secondary prevention** which consequently excludes screening for secondary prevention.
- Policies do not address systematic surveillance, monitoring, and evaluation of CVD screening and diagnostic services in Group 3 countries.

CVD diagnostics guidelines are infrequently updated with guidelines in Group 2 and Group 3 countries not fully aligned with global best practices:

- CVD diagnostics guidelines in Group 2 and Group 3 countries are updated infrequently; the transition to actual implementation can take several years.
- Diagnostic guidelines in Group 2 and Group 3 countries are not fully aligned with global best practices and often do not cover relatively novel diagnostics such as cardiac biomarkers. Novel cardiac biomarkers such as natriuretic peptide (NT-proBNP or BNP) and high-sensitivity troponin have been shown to be crucial in the timely diagnosis and prognosis of symptomatic patients for heart failure and acute coronary syndrome respectively.[202,203] However, in Group 2 and Group 3 countries, adoption of these biomarkers has been slow due to their high out-of-pocket costs and lack of reimbursement as well as limited awareness amongst clinicians and diagnostic technicians on the use of these biomarkers.
- Furthermore, the lack of regional/national CVD research and data means that screening and diagnostic guidelines are not contextualized to local populations, in the same group of countries.

Screening promotion and coverage needs to be strengthened in rural areas and especially for high-risk groups.

- There are varying gaps in coverage and uptake of screening and diagnostic services across the 9 countries. Screening services in Japan, India, Indonesia, and Malaysia specifically saw low uptake from at-risk groups including middle-aged persons (Japan), the elderly (Indonesia) and those from lower socioeconomic groups (India and Malaysia).[204,205,206,207]
- Gaps in screening services persist, particularly in rural areas in China, Malaysia, and Group 3 countries.[208,209]

Out-of-pocket costs for diagnostics remain a barrier to uptake in Group 3 countries.

Marked shortage of front-line workers for screening and follow-up in five out of nine countries:

- In China, India, Indonesia, Malaysia, and Vietnam there is a significant shortage of community health workers and allied health workers to carry out screening.[210,211] India and Malaysia rely on volunteer community workers who are often not compensated proportionally with limited accountability which leads to gaps in coverage of the population and loss to follow up.[212,213]

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- In China, India, Indonesia, Malaysia, and Vietnam there is a significant shortage of community health workers and allied health workers to carry out screening.[210,211] India and Malaysia rely on volunteer community workers who are often not compensated proportionally with limited accountability which leads to gaps in coverage of the population and loss to follow up.[212,213]

Group 2 and Group 3 countries lack the

Findings: Management Of Established CVDs

Gaps in emergency medical services (EMS), acute care capacity, and secondary prevention remain an issue across a majority of these countries.

Table 24: Strength of screening and diagnostic policies across the nine countries

	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Comprehensiveness of EMS planning for CVD events	H	M	H	M	M	M	VL	VL	VL
Basic availability of critical care and procedure / surgery	VH	VH	VH	H	VH	VH	M	H	H
Quality of Acute Care Services	H	H	H	H	M	H	VL	L	M
Monitoring & Rehabilitation service comprehensiveness and coverage	VH	M	H	H	H	M	M	L	L
Essential CVD Workforce Availability in Public Hospitals for CVD	H	H	VH	L	M	M	L	L	M
Availability of essential medicines	VH	VH	M	H	H	M	M	H	M
Accessibility of Step Down Care	H	L	L	VL	VL	NA	VL	NA	NA
Robustness of Secondary Prevention	H	H	H	H	H	VH	M	M	L
Integrated care comprehensiveness	H	VL	H	M	M	M	VL	VL	VL

Very low Low Moderate High Very high

Except for Indonesia and Vietnam, a majority of the Asia Pacific countries have established a national emergency medical service (EMS) plan. However, pre-hospital rescue services remain challenged by poor EMS capacity and low CPR awareness.

- Pre-hospital rescue is often delayed in Group 3 countries, India,[214] Indonesia,[215] Vietnam,[216,217] as well as some Group 2 countries such as Malaysia due to poor ambulance provisioning, and shortages of emergency medical staff such as trained paramedics.[218,219,220]
- Lack of nearby emergency services in rural areas contribute to disparities in response time in China,[221] India,[222] Indonesia,[223] Japan,[224] South Korea,[225] and Vietnam.[226]
- Poor public awareness of AED and low CPR training among residents is an acute gap in all nine Asia Pacific countries' response to sudden cardiac episodes.
- Several of these countries, including India,[227] Japan, Indonesia, Thailand, and Vietnam[228] lack a formal community CPR training program or responder networks to administer bystander CPR.

Limited acute care capacity in the public sector is a challenge in four of the Group 2 and Group 3 countries – namely Thailand, India, Vietnam, and Malaysia.

- Most of the Asia-Pacific countries face maldistribution of acute care services between cities and villages.
- Public acute care services are limited in Thailand, India,[229] Vietnam,[230] and Malaysia[231] due to limited availability of essential CVD workforce (e.g., cardiologists, cardiac nurses) and poor acute care infrastructure. In India, the private sector contributes between 60 - 70% of acute care services to compensate for gaps in public acute care.[232]
- Across all Asia-Pacific countries, many of public and private acute care facilities are concentrated in metropolitan areas, while similar facilities are lacking in rural and remote villages. In South Korea and Indonesia, heart specialists are limited outside of cities.[233]

In the nine Asia Pacific countries, most essential CVD drugs are available at the secondary and tertiary care level.

- Accessing fixed dose combination drugs remains a challenge for patients in Malaysia, South Korea, Thailand, Vietnam. In South Korea, fixed dose combinations remain relatively expensive.[234] The public healthcare sector in Malaysia and Vietnam do not have access to fixed dose combinations drugs.[235]
- Supply chain issues have also reduced availability of essential CVD drugs available in China, India, and Thailand. Both India and Thailand public healthcare systems suffer from shortages of CVD medicine due to sub-optimal distribution.[236,237] In China, CVD drug shortages were reported during the COVID-19 pandemic.[238,239]
- Many of the essential CVD drugs may not be available at the primary care level in Indonesia and Vietnam. Many primary care centers in Indonesia, or puskesmas, lack essential CVD drugs such as ACE inhibitors and anti-coagulants.[240] Whereas in Vietnam, drugs are mostly dispensed at the tertiary care level.[241]

Group 1 and Group 2 countries have secondary prevention guidelines and programs to monitor high-risk CVD patients, whereas Group 3 countries lack similar guidelines and linkages across the different levels of care.

- Physician awareness and patient adherence to secondary prevention clinical guidelines was also a challenge across the countries. In China, only half the number of physicians reported awareness of secondary prevention

guidelines, while amongst patients, only 1 in 12 high-risk patients would take their prescribed CVD medications.[242]

All Asia Pacific countries except Australia lack comprehensive cardiac rehabilitation (CR) programs and policies to promote step-down care of CVD patients.

- While CR services are mandatory and covered by national health insurance in Group 1 countries (i.e., Japan and South Korea), lack of trained multi-disciplinary professionals have slowed the implementation of CR programs in many healthcare institutions.[243]
- In Group 2 and Group 3 countries, leading private hospitals in cities run most of existing CR programs with limited coverage. Hence, most rural patients lack access to CR services.
  - Step-down or discharge care pathways are also not clearly established in Malaysia, India,[244] Indonesia, and other UMI/Group 3 countries.
- While most Group 1 and Group 2 countries have implemented integrated care models to support chronic and CVD patients with varying degrees of progress, there is a lack of progress in developing similar pathways in Group 3 countries.
  - While Japan is establishing integrated care wards across hospitals, with some including cardiac rehabilitation. However, the focuses of these wards vary according to prefectural authorities' priorities. Progress for these pilots also vary across Japan's geography.
  - In Group 2 countries (i.e., China, Malaysia, and Thailand), integrated care models are being planned and piloted. Both China and Thailand have rolled out pilot programs focusing on hypertension care management by multi-disciplinary teams. China is also piloting integrated chronic disease models in both urban and rural counties.[245,246,247]
  - Group 3 countries – India, Indonesia, and Vietnam – lack comprehensive integrated care planning, stymied by a lack of cohesive policy and inadequate human resources to operationalize CVD patient management across different levels of care.[248,249,250]

Findings: Systems Readiness

Workforce shortages and the lack of data on CVD prevention, screening, and management are challenges across the region.

Table 25: Strength of national registries, systems available for maintaining clinical guidelines, supply chain resilience and healthcare system digital readiness across the nine countries

	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
Comprehensive National Registries	VH	VH	VH	VH	MYS	VH	H	VH	VL
Effective system for developing and maintaining clinical guidelines	VH	VH	VH	H	H	H	VL	VH	VH
Workforce Planning	H	M	H	L	L	L	VL	L	L
Supply Chain Resilience	H	VH	VH	VH	L	L	VL	M	L
Healthcare System Digital Readiness	VH	L	VH	H	L	H	H	VL	M
Research, Development and Innovation	VH	VH	VH	M	VL	VL	VL	L	L

Very low Low Moderate High Very high

Implementation of CVD registries is uneven in Group 2 and Group 3 countries

- With the exception of Vietnam, a majority of the countries have established national CVD registries covering major CVDs. However, in India, Indonesia, Malaysia, and Thailand registries are infrequently updated and lack comprehensive coverage of all CVDs.
- Integration of registries with electronic health records is limited with Australia, South Korea[251] and China making plans to integrate them.
- In both Japan and Malaysia, data collection practices are not standardized which impacts the quality of data.

Workforce gaps persist across all countries in varying proportions – rural workforce retention remains a significant issue in seven out of nine countries

- Rural workforce retention is a notable issue in at least seven of the nine countries, including China, Australia, Thailand, South Korea, India, Indonesia, and Vietnam.
- In Group 3 countries, challenges mainly arise from a lack of budget, inadequate incentives, and the absence of sufficient training programs for specialized CVD or non-communicable disease (NCD) workforces, which affects workforce development and retention.[252,253,254]
- Group 2 countries, such as Malaysia and China,[255] provide training programs, but addressing workforce shortages requires efforts to reduce barriers to specialization
- In Thailand, the inequitable distribution of healthcare professionals hampers the delivery of CVD services in rural areas.[256]
- South Korea and Australia, face workforce retention issues due to poor working conditions.[257,258]

Research, development, and innovation are not prioritized at the policy level for Group 2 and Group 3 countries

- The lack of a ministry-led roadmap/ strategy for addressing NCDs and CVDs is observed in several countries, including India, Indonesia, Vietnam, Malaysia, China, and Thailand. In these countries, research efforts are primarily led by patient associations and healthcare experts with research funding being a cause of concern. This results in CVD-specific research projects competing with multiple projects for funding from the national research grants.
  - In China, CVD efforts are conducted at both the national and provincial levels.[259]
  - In Vietnam and Thailand, ad-hoc projects related to CVD are carried out by NGOs with Vietnam facing challenges in scaling up existing hypertension programs due to difficulties in obtaining funding.[260]
  - Moreover, the lack of a roadmap has led to countries such as Vietnam adopting the American Heart Association clinical guidelines[261] despite differences in demographics, lifestyle and diet between a Western population and Southeast Asian population.
- Group 1 countries have a comprehensive roadmap with plans in place to support projects for prevention and management in hospitals and provincial areas. The presence of such a roadmap has resulted in country-specific findings in cardiovascular disease trends and risk factors.
  - The Korean Heart Study group found that Koreans have a lower risk of IHD, but a higher risk of stroke compared to Western populations despite sharing the same risk factors.[262]

Clinical practice guidelines are updated between two to five years for most countries.

- Guidelines are updated at intervals of 2-5 years for a majority of countries except Malaysia where updates take place more than five years apart.

- With no national guidelines on CVD management in India, most practitioners follow US or European guidelines. The lack of a mandate for Continuous Medical Education indicates that there may be a significant gap between care currently being practiced and updated guidelines.[263]
- Treatment for HF, also known as Guideline Directed Medical Therapy (GDMT), is well-established in European and US guidelines. However, its utilization is suboptimal globally and particularly poor in low-and middle-income countries due to a lack of awareness amongst patients and physicians, high out-of-pocket costs due to insufficient insurance coverage. Women were most likely to be prescribed guideline-recommended drugs.[263]
    - Clinical practice guidelines for management and treatment of dyslipidaemia are present across majority of the countries with the exception of India. These countries have worked together with the local heart association to craft dyslipidaemia guidelines specific to their respective population.[264,265,266,267]

Due to multiple factors, novel drugs and diagnostics are unlikely to be covered by national health plans and require significant out-of-pocket payments

- The health financing and workforce gap, especially in Group 2 and Group 3 countries, limits governments' ability to evaluate and provide coverage for innovative treatments such as heart valve replacements and the use of novel diagnostics.

There is a lack of national data on CVD, particularly service delivery (screening services, acute care, and chronic CVD management) and service uptake.

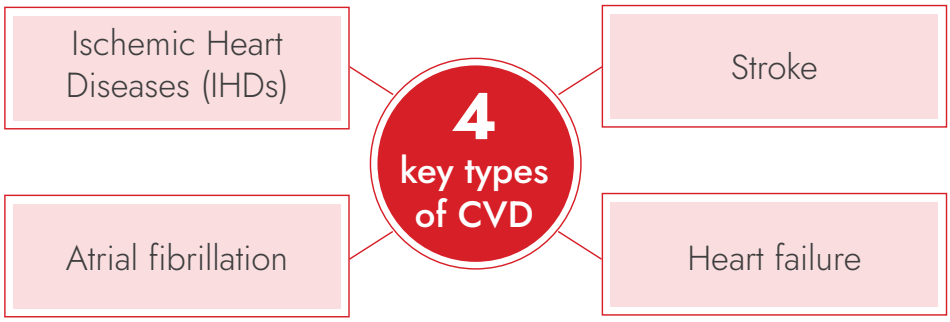
- Except for India, the other countries have developed an effective system for developing and maintaining clinical guidelines. The absence of a known authoritative body reviewing and updating the effectiveness of CVD guidelines has impeded India's progress in developing an effective system for maintaining clinical guidelines.
- In comparison, Australia has set up the Australian Living Evidence Collaboration organization to pilot a living guideline that constantly monitors research and clinical trials to expedite the incorporation of new findings and treatments.[268] This results in a system that delivers evidence-based summaries of the latest research to drive better care and health outcomes.

METHODOLOGY

Cardiovascular Disease Burden

To analyse the disease burden of CVDs, we extracted data from the Institute for Health Metrics and Evaluation's (IHME) Global Burden of Disease (GBD) study. The study has data for all nine Asia Pacific countries for this report, namely Australia, China, India, Indonesia, Japan, Malaysia, South Korea, Thailand, and Vietnam.

Our analysis focused on four major types of CVDs:



IHDs and stroke are the largest contributors to CVD burden and mortality across the Asia-Pacific region and globally, meriting their analysis in this report. Atrial fibrillation remains the most common form of abnormal heart rhythm, and is associated with a higher risk of stroke, with growing number of cases due to ageing populations, and increasing risk factors. Finally, heart failure remains the world's leading cause of hospitalization, with a substantially high prevalence globally.

INCIDENCE, PREVALENCE, DISEASE BURDEN, AND MORTALITY

To inform of changes in CVD trends over the past decade, we plotted GBD data to look at incidence, prevalence, disease burden, and mortality of IHDs, stroke, and atrial fibrillation in the nine Asia Pacific countries over the 2009 - 2019 period (Appendix X). Noting how the trends remained consistent in that time period, we compared the percentage change in incidence and mortality rates between 2009 and 2019.

RISK FACTOR

To ascertain major risk factors contributing towards major CVDs, we indexed the top risk factors based on their overall disease burden (DALYs) contribution in 2019. While IHDs, stroke, and atrial fibrillation share common risk factors (e.g., high blood pressure, dietary risks, tobacco, high BMI), the proportion of burden attributable to CVD risks differs across each major CVDs. Hence, we analysed risk factor contribution towards DALYs separately for each major CVD.

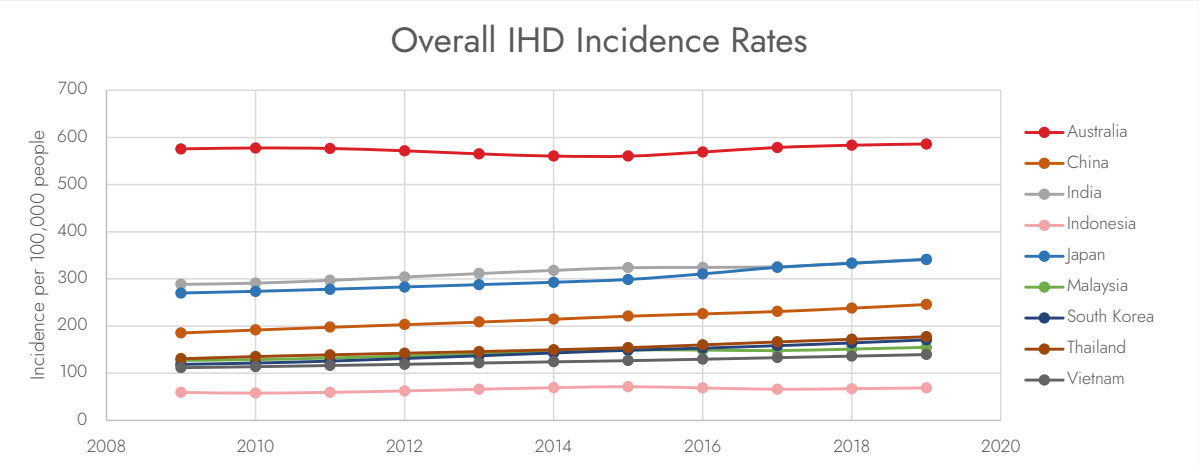
GENDER

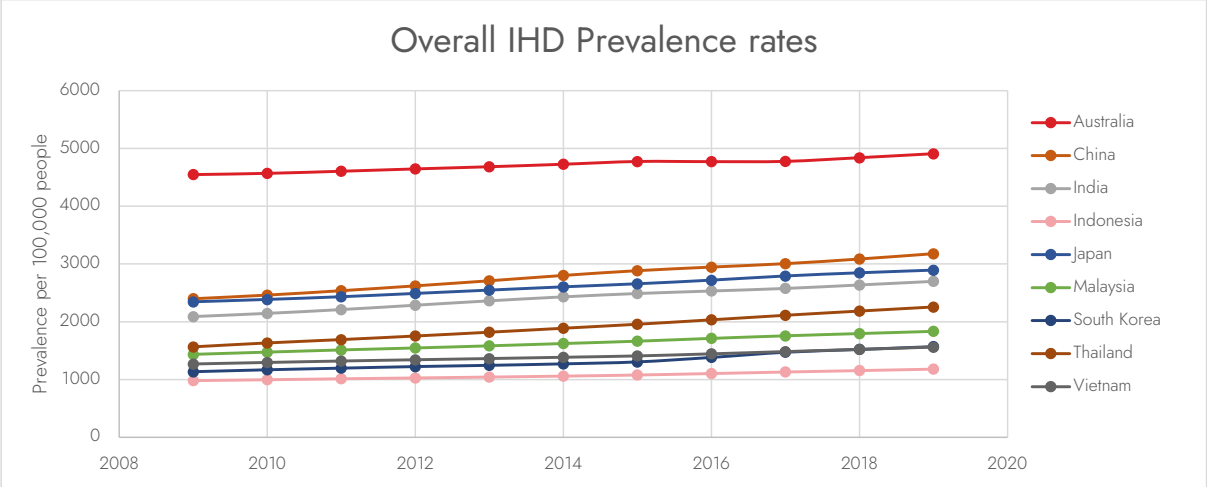
Across the Asia-Pacific countries, we conducted a gender stratified analysis to account for any differences that may arise from a combination of biological or socio-behavioural factors in each gender (i.e., males and females). We first compared the differences in incidence, prevalence, DALYs, and mortality rates in 2019 between these genders. Similarly, we indexed the top risk factors' contribution towards major CVDs across gender for each country, comparing the change in proportion between the 2011 and 2019 (Appendix 2).

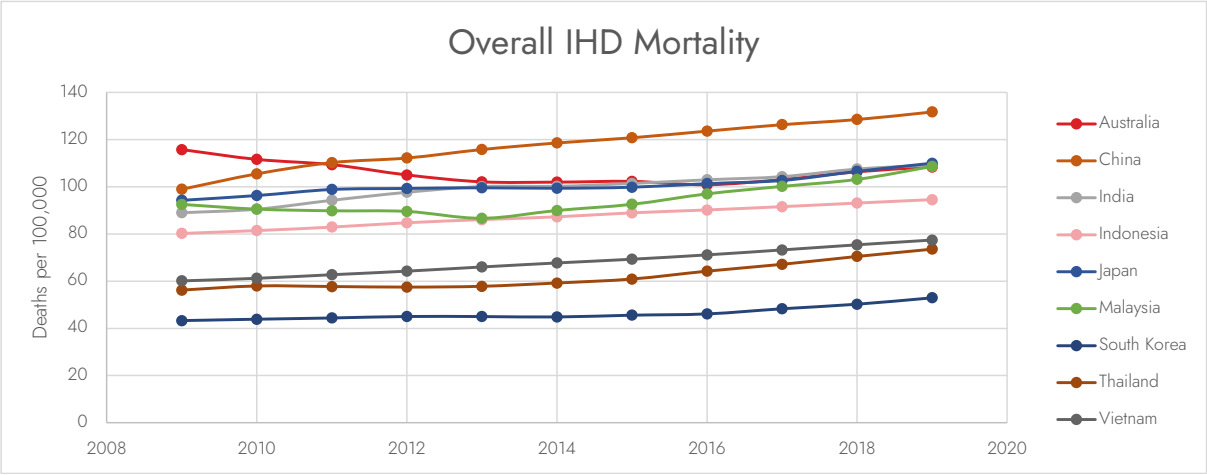
HEART FAILURE

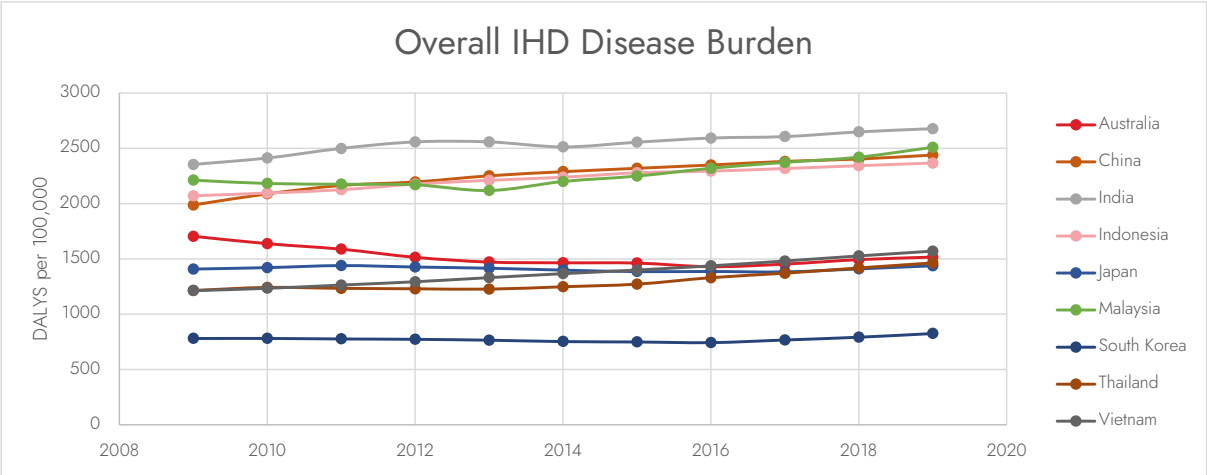
As the availability of data on heart failure (HF) in the Asia-Pacific was limited, we relied on literature review of academic research on HF to understand and present the growing burden of the HF epidemic.

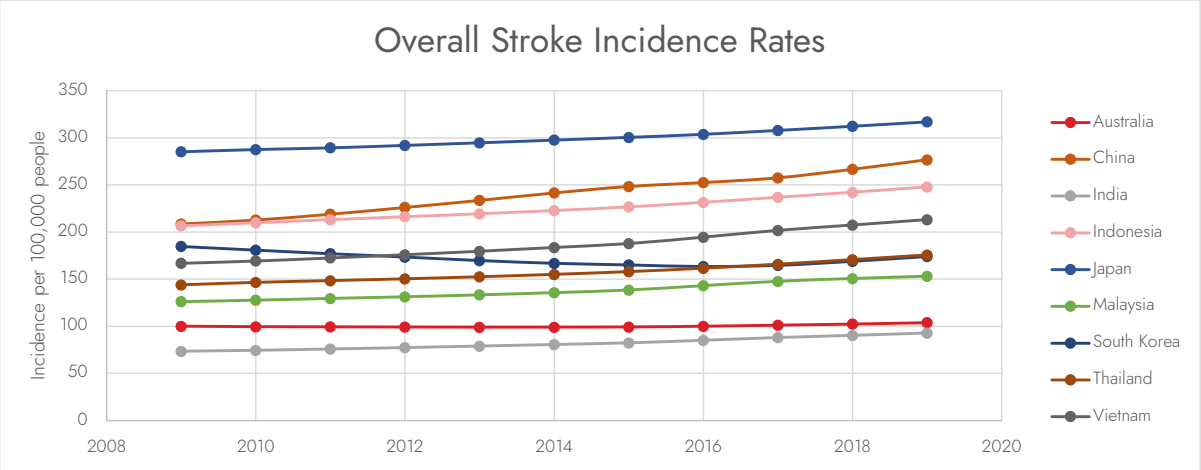
Appendix 1: Overall Incidence, Prevalence, Disease Burden, and Mortality rates of Ischemic heart disease, stroke, and atrial fibrillation

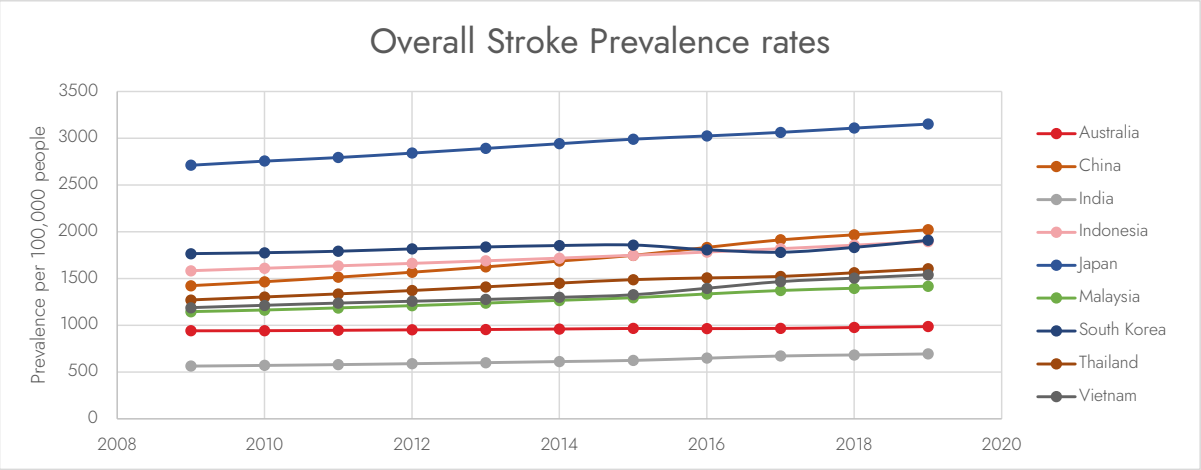



Overall IHD Prevalence rates
Prevalence per 100,000 people
6000
5000
4000
3000
2000
1000
0
2008
2010
2012
2014
2016
2018
2020
Australia
China
India
Indonesia
Japan
Malaysia
South Korea
Thailand
Vietnam


Overall IHD Mortality
Deaths per 100,000
140
120
100
80
60
40
20
0
2008
2010
2012
2014
2016
2018
2020
Australia
China
India
Indonesia
Japan
Malaysia
South Korea
Thailand
Vietnam


Overall IHD Disease Burden
DALYS per 100,000
3000
2500
2000
1500
1000
500
0
2008
2010
2012
2014
2016
2018
2020
Australia
China
India
Indonesia
Japan
Malaysia
South Korea
Thailand
Vietnam


Overall Stroke Incidence Rates
Incidence per 100,000 people
350
300
250
200
150
100
50
0
2008
2010
2012
2014
2016
2018
2020
Australia
China
India
Indonesia
Japan
Malaysia
South Korea
Thailand
Vietnam


Overall Stroke Prevalence rates
Prevalence per 100,000 people
3500
3000
2500
2000
1500
1000
500
0
2008
2010
2012
2014
2016
2018
2020
Australia
China
India
Indonesia
Japan
Malaysia
South Korea
Thailand
Vietnam


EKG
65 BPM
BRAIN ACTIVITY
60 %
RESP
34 RPM
DATA LOG
ETO2 59
INO2 65
ETN2O 0
INN2O 0
NIBP
113/76 (86)
INTERVAL 35 MIN
ET 1 MIN
MAX

Appendix 1: Overall Incidence, Prevalence, Disease Burden, and Mortality rates of Ischemic heart disease, stroke, and atrial fibrillation

Figure 15: Top five risk factors contributing towards IHD burden in males (left) and females (right) across nine Asia-Pacific countries.[269]

Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019	Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019
Australia					
Dietary risks	1102	-7	Dietary risks	567	-9
High blood pressure	1003	-8	High blood pressure	539	-10
High LDL cholesterol	994	-6	High LDL cholesterol	518	-9
High body-mass index	561	-5	High body-mass index	272	-6
High plasma glucose	498	-7	High plasma glucose	229	-26
China					
Dietary risks	1764	7	Dietary risks	1041	9
High blood pressure	1556	11	High blood pressure	1043	15
High LDL cholesterol	1323	7	High LDL cholesterol	831	11
Tobacco	1270	7	Air pollution	530	4
Air pollution	874	1	High plasma glucose	339	3
India					
Dietary risks	2024	3	Dietary risks	1180	21
High blood pressure	1704	2	High blood pressure	1080	19
High LDL cholesterol	1489	3	High LDL cholesterol	886	23
Air pollution	1202	1	Air pollution	703	18
High plasma glucose	945	45	High plasma glucose	538	58
Indonesia					
High blood pressure	1841	10	High blood pressure	1256	6
Dietary risks	1676	7	Dietary risks	986	3
High LDL cholesterol	1288	7	High LDL cholesterol	796	4
Tobacco	1293	9	Air pollution	431	-9
Air pollution	679	-6	High body-mass index	426	15
Japan					
High blood pressure	971	-6	High blood pressure	523	2
Dietary risks	899	-6	Dietary risks	519	4
High LDL cholesterol	801	-7	High LDL cholesterol	483	3
Tobacco	547	-21	Kidney dysfunction	172	10
High plasma glucose	366	17	High plasma glucose	162	26

Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019	Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019
		Malaysia			
High blood pressure	2135	14	High blood pressure	1075	16
High LDL cholesterol	2010	11	High LDL cholesterol	895	14
Dietary risks	1912	12	Dietary risks	853	14
Tobacco	1318	4	High plasma glucose	478	28
High body-mass index	901	23	High body-mass index	407	25
		South Korea			
Dietary risks	536	-2	Dietary risks	345	14
High LDL cholesterol	461	-5	High LDL cholesterol	283	12
High blood pressure	410	-4	High blood pressure	281	7
Tobacco	369	-14	High plasma glucose	155	43
High plasma glucose	257	26	Air pollution	106	22
		Thailand			
High LDL cholesterol	1060	18	High LDL cholesterol	543	12
Dietary risks	993	20	Dietary risks	485	13
High blood pressure	893	19	High blood pressure	451	12
Tobacco	672	14	High plasma glucose	255	59
Air pollution	453	4	Air pollution	221	-3
		Vietnam			
High blood pressure	1276	25	High blood pressure	579	10
Dietary risks	1134	27	Dietary risks	513	17
High LDL cholesterol	959	28	High LDL cholesterol	470	18
Tobacco	898	24	High plasma glucose	285	35
High plasma glucose	479	48	Air pollution	238	0

Figure 16: Top five risk factors contributing towards stroke burden in males (left) and females (right) across nine Asia-Pacific countries.[270]

Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019	Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019
		Australia			
High blood pressure	345	3	High blood pressure	385	-3
High body-mass index	194	2	High body-mass index	216	-1
Dietary risks	189	-1	Dietary risks	210	-4
High plasma glucose	170	8	High plasma glucose	138	-17
High LDL cholesterol	92	3	High LDL cholesterol	131	-2

Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019	Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019
Australia					
High blood pressure	345	3	High blood pressure	385	-3
High body-mass index	194	2	High body-mass index	216	-1
Dietary risks	189	-1	Dietary risks	210	-4
High plasma glucose	170	8	High plasma glucose	138	-17
High LDL cholesterol	92	3	High LDL cholesterol	131	-2
India					
High blood pressure	706	-3	High blood pressure	673	8
Air pollution	548	-2	Air pollution	502	11
Dietary risks	379	-4	Dietary risks	321	9
High plasma glucose	372	40	High plasma glucose	297	46
Tobacco	289	-6	High body-mass index	286	39
Indonesia					
High blood pressure	2204	10	High blood pressure	2265	6
Dietary risks	1130	7	Dietary risks	966	2
Tobacco	1164	11	High body-mass index	974	17
Air pollution	850	-9	Air pollution	865	-11
High body-mass index	819	32	High plasma glucose	535	22
Japan					
High blood pressure	1070	-3	High blood pressure	843	4
Dietary risks	503	-6	Dietary risks	395	1
Tobacco	464	-19	High LDL cholesterol	230	11
High plasma glucose	374	19	High plasma glucose	221	27
High body-mass index	226	-8	Tobacco	179	-11
Malaysia					
High blood pressure	1139	16	High blood pressure	987	14
High body-mass index	614	21	High body-mass index	509	17
Dietary risks	579	13	Dietary risks	443	11
High plasma glucose	397	28	High plasma glucose	396	26
Tobacco	510	7	Air pollution	225	3
South Korea					
High blood pressure	609	-9	High blood pressure	543	-4
Dietary risks	486	-7	Dietary risks	398	-2
High plasma glucose	357	17	High plasma glucose	257	24
Air pollution	319	7	Air pollution	268	14
Tobacco	408	-17	High body-mass index	185	5

Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019	Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019
Thailand					
High blood pressure	1119	12	High blood pressure	618	7
Dietary risks	759	12	Dietary risks	419	7
High body-mass index	699	24	High body-mass index	412	13
Tobacco	637	10	Air pollution	381	-7
Air pollution	621	-2	High plasma glucose	293	54
Vietnam					
High blood pressure	2689	5	High blood pressure	1232	-11
Dietary risks	1613	6	Dietary risks	699	-4
Air pollution	1196	-13	Air pollution	608	-19
Tobacco	1484	3	High plasma glucose	546	9
High plasma glucose	866	28	High body-mass index	299	22

Figure 17: Top five risk factors contributing towards atrial fibrillation burden in males (left) and females (right) across nine Asia-Pacific countries in 2019.[271]

Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019	Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019
Australia					
High blood pressure	110	18	High blood pressure	113	10
High body-mass index	82	22	High body-mass index	103	14
Alcohol use	63	14	Alcohol use	29	7
Tobacco	19	-10	Tobacco	13	-2
Other environmental risks	7	1	Other environmental risks	5	-4
China					
High blood pressure	40	28	High blood pressure	59	31
Tobacco	23	26	High body-mass index	20	28
Dietary risks	17	24	Dietary risks	16	52
Alcohol use	15	37	Other environmental risks	4	21
High body-mass index	12	52	Tobacco	4	16
India					
High blood pressure	27	25	High blood pressure	32	26
High body-mass index	8	82	High body-mass index	11	74
Tobacco	8	14	Other environmental risks	5	24
Other environmental risks	5	17	Dietary risks	3	25
Alcohol use	5	59	Tobacco	1	19

Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019	Top 5 Risk Factors	DALYs in 2019	% change from 2011 to 2019
Indonesia					
High blood pressure	36	21	High blood pressure	46	17
Tobacco	15	19	High body-mass index	12	49
Dietary risks	8	18	Dietary risks	6	15
High body-mass index	8	55	Other environmental risks	2	7
Other environmental risks	2	398	Tobacco	1	9
Japan					
High blood pressure	77	17	High blood pressure	46	23
Tobacco	24	-5	High body-mass index	15	31
Alcohol use	24	23	Alcohol use	8	30
High body-mass index	19	23	Dietary risks	7	18
Dietary risks	15	11	Tobacco	3	5
Malaysia					
High blood pressure	39	27	High blood pressure	41	21
High body-mass index	16	45	High body-mass index	18	39
Tobacco	12	8	Dietary risks	6	18
Dietary risks	8	23	Tobacco	1	-8
Alcohol use	3	31	Other environmental risks	1	11
South Korea					
High blood pressure	32	27	High blood pressure	25	29
Alcohol use	21	40	High body-mass index	12	57
Tobacco	19	15	Alcohol use	8	52
High body-mass index	14	52	Dietary risks	7	34
Dietary risks	11	33	Tobacco	2	13
Thailand					
High blood pressure	42	32	High blood pressure	46	27
Alcohol use	20	34	High body-mass index	26	50
Tobacco	18	25	Dietary risks	9	29
High body-mass index	18	62	Alcohol use	3	31
Dietary risks	12	31	Tobacco	2	9
Vietnam					
High blood pressure	38	20	High blood pressure	45	8
Tobacco	17	21	High body-mass index	11	44
Alcohol use	16	56	Dietary risks	7	14
Dietary risks	9	20	Alcohol use	1	7
High body-mass index	7	70	Tobacco	1	-7

ECONOMIC BURDEN

The economic burden is split into direct and indirect costs, where direct costs include the immediate, measurable expenses associated with the diagnosis, treatment, and management of CVD. These costs typically include expenses related to hospitalization, physician consultations, pharmaceuticals, surgical procedures, and diagnostic tests. Indirect costs, on the other hand, are the less apparent but substantial economic consequences arising from CVD. These costs extend beyond the healthcare system and encompass factors such as lost productivity, absenteeism, and reduced work capacity of both affected individuals and their caregivers.

Direct costs of CVD for each of the nine countries were sourced from secondary research that encompassed government bulletins, policy papers, and academic research. Where multiple sources were available, the most recent data was included.

In the absence of data on direct spending on CVD in India, the projected national income foregone due to heart disease, stroke, and diabetes in 2015, conservatively estimated at 23.6 USD billion, was used in its place[272]. Data for Vietnam was not available; the direct costs of inpatient and outpatient care for smoking-attributable CVD were taken as a substitute.[273] The total health expenditure for the same year was sourced from government websites, research papers, or research databases.

Given that more recent data was not available for a number of these countries while there has been a steady increase in disease burden for all countries over the last two decades, the direct costs of CVD exceed the total figure calculated in this report.

Indirect costs were also identified in the same manner.

CVD Strategy Evaluation Methodology

Indicators were selected for A-E based on benchmarking from countries with existing CVD strategies, WHO, EU, NICE and AHA guidelines, expert interviews, and research papers. Findings across countries from B-E were iteratively used to refine indicators within and across each section. Desktop literature, and expert and patient interviews were used in gathering data.

Nine countries in Asia Pacific (Australia, Japan, South Korea, China, Malaysia, Thailand, India, Indonesia, and Vietnam), were chosen to represent the diverse contextual differences and challenges within the region. Detailed descriptive data was consolidated for each country based on their national health policy including CVD-related policies, policy implementation and whether there were M&E

programs for each component along the pathway.

A scorecard was developed from the above framework to compare and contrast findings across countries and within patient pathway segments. The scorecard was developed in three parts: a raw indicator sheet, a country scorecard of scores for subsections under sections A-E, followed by a final regional scorecard with the CVD indicators for each section of the framework.

Scoring rules were defined for each indicator. Each section A-E had subsections within which indicators were organized. The subtotals were combined to provide summary scores for A-E per country. These were colour graded to indicate whether the subsection policy strength was low, moderate, or strong.
Given the role of national income in determining healthcare spending, and consequently other downstream healthcare system factors, the nine countries were divided into groups based on their national income and arranged in the scorecard.

Grouping of countries based on national income

Group 1 High-Income	Group 2 Upper-middle Income	Group 3 Lower-middle Income
Australia (AUS)	China (CHN)	India (IND)
Japan (JPN)	Malaysia (MYS)	Indonesia (IDN)
Korea (KOR)	Thailand (THA)	Vietnam (VNM)

Country Scorecard

DOMAIN	INDICATOR	SCORING	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
National CVD Policy	*Overall health policy score based on focus on NCDs, CVDs, has a dedicated budget for NCDs and/ or CVDs, has specific CVD targets, comprehensiveness of CVD targets, diagnostics strategy, CVD disease specific goals, policy formulation involves cardiac experts, and includes healthcare quality, addresses equitable access to marginalized groups, involvement of patient groups.*	*Inadequate= 0-33% Adequate= 34%-63% Strong>63%*	VH	VH	VH	M	M	M	M	M	M

Very low Low Moderate High Very high

DOMAIN	INDICATOR	SCORING	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM
B. Health promotion and prevention											
Effective system for developing and maintaining clinical guidelines Workforce Planning Supply Chain Resilience	*Physical activity*	*"Inadequate = 0-33% Adequate = 34%-63% Strong > 65 %"*	VL	L	VL	H	VH	M	L	VL	VL
	Healthy Diet (Obesity)	*"Inadequate = 0-33% Adequate = 34%-63% Strong > 65 %"*	L	L	M	VL	VL	H	VL	L	VL
	Alcohol reduction	*"Inadequate = 0-33% Adequate = 34%-63% Strong > 65 %"*	H	M	L	M	H	H	M	VH	M
	Tobacco-demand reduction	*"Inadequate = 0-33% Adequate = 34%-63% Strong > 65 %"*	VH	L	H	L	M	VH	H	VL	H
Healthcare System Digital Readiness	*Effectiveness of CVD awareness programs*	*"Inadequate = 0-33% Adequate = 34%-63% Strong > 65 %"*	M	M	M	M	L	M	L	M	M
Research, Development and Innovation	*Adequate guidelines for Primary prevention of CVD in primary care centres*	*"Inadequate = 0-33% Adequate = 34%-63% Strong > 65 %"*	VH	VH	H	VH	VH	VH	H	H	H

Where data was unavailable from government websites or formal associations such as national or subnational cardiac associations, research articles and grey literature as well as expert interviews experts were used to inform the scoring. Where data could not be found, indicators were left unscored. Scores were converted to percentages to ensure comparability across subsections with varying number of indicators.

Scoring rules

% Score= [Sum of scores for each subsection/ Sum of maximum scores per indicator within a subsection where the respective country cell has a value] * 100

Scores were colour graded as follows.

Very low Low Moderate High Very high

The regional scorecard provides a bird's eye view of areas that are commonly low or strong among the nine countries:

Countries	Policies	Health Promotion and Prevention							Screening and diagnosis						Management of Established CVD										System Readiness						
	Policies	Effectiveness of risk reduction programmes				CVD Awareness Programs	Adequate guidelines for Primary prevention of CVD in primary care centres	overall score of health promotion and prevention pro-	Screening policies	Effectiveness of screening programs	Overall strength of screening	Comprehensiveness of diagnostics policies	Diagnostic capacity	Overall Strength of Diagnostics	Comprehensiveness of EMS planning for CVD events	Basic availability of critial care and procedure / surgery	Quality of Acute Care Services	Monitoring & rehabilitation service comprehensiveness and coverage	Availability of Essential CVD Workforce in Public hospitals to treat major CVD	Availability of essential medicines	Accessibility of Step Down Care	Robustness of secondary prevention	Integrated care comprehensiveness	overall management of established CVD	Comprehensive National Registries	Effective system for developing and maintaining clinical guidelines	Workforce Planning	Supply Chain Resilience	Healthcare System Digital Readiness	Research, Development and Innovation	overall score of system readiness
		Physical activity	Healthy Diet (Obesity)	Alcohol reduction	Tobacco-demand reduction																										
Australia	VH	VL	L	H	VH	M	VH	M	M	H	M	VH	VH	VH	H	VH	H	VH	H	VH	H	H	H	H	VH	VH	H	H	VH	VH	VH
Japan	VH	L	L	M	L	M	VH	M	VH	VH	VH	H	VH	VH	M	VH	H	M	H	VH	L	H	VL	M	VH	VH	M	VH	L	VH	H
Korea	VH	VL	M	L	H	M	H	M	VH	VH	VH	H	VH	VH	H	VH	H	H	VH	M	L	H	H	H	VH	VH	H	VH	VH	VH	VH
China	M	H	VL	M	L	M	VH	M	M	VH	M	H	M	H	M	H	H	H	L	H	VL	H	M	M	VH	H	L	H	H	M	H
Malaysia	M	VH	VL	H	M	L	VH	M	M	M	M	L	H	M	M	VH	M	H	M	H	VL	H	M	M	M	H	L	L	L	VL	L
Thailand	M	M	H	H	VH	M	H	H	H	H	H	H	VH	VH	M	VH	H	M	M	M	NA	VH	M	H	VH	H	L	L	H	VL	M
India	M	L	VL	M	H	L	H	L	M	M	M	M	H	H	VL	M	VL	M	L	M	VL	M	VL	L	H	VL	VL	VL	H	VL	L
Indonesia	M	VL	L	VH	VL	M	H	M	H	H	H	M	H	H	VL	H	L	L	L	H	NA	M	VL	L	VH	VH	L	M	VL	L	M
Vietnam	M	VL	VL	M	H	M	H	M	M	M	M	L	H	M	VL	H	M	L	M	M	NA	L	VL	L	VL	VH	L	L	M	L	L

ANNEX

Full Policy Analysis Scorecard

National health policy addresses the following key CVD policy components	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM	*No. of countries with this component*
					(I) Specificity in design					
NCD policy	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Dedicated CVD policy	✓	✓	✓	✗	✗	✗	✗	✗	✗	*3*
CVD reduction targets	✗	✓	✓	✗	✓	✓	✗	✗	✗	*4*
Comprehensiveness of upstream targets	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
CVD policy includes strategy on screening	✗	✓	✓	✗	✓	✓	✗	✗	✗	*4*
CVD policy includes strategy on diagnostics	✗	✗	✗	✗	✗	✓	✗	✗	✗	*1*
Includes objectives or strategies for management of acute and chronic CVD	✓	✓	✓	✗	✗	✗	✗	✓	✗	*4*
Objectives or strategies for secondary prevention	✓	✓	✓	✗	✗	✗	✗	✗	✗	*3*
Policy includes a strategy for promoting CVD research	✓	✓	✓	✗	✗	✗	✗	✗	✗	*3*
Disease-specific goals	✓	✗	✗	✗	✓	✗	✗	✗	✓	*3*
Maintaining healthcare quality	✓	✓	✓	✓	✓	✓	✗	✓	✓	*8*
					(II) Inclusive and equitable policy formulation					
Formulated in consultation with cardiac experts	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Involvement of patient groups	✓	✓	✗	✗	✗	✗	✗	✓	✗	*3*
Policies addressing equitable access to care to CVD	✓	✓	✓	✓	✓	✗	✓	✓	✓	*9*

National health policy addresses the following key CVD policy components	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM	*No. of countries with this component*
Any inequities in care access across gender/ socioeconomic groups	✓	✓	✓	✗	✗	✗	✗	✗	✗	*3*
Programmes addressing equitable CVD care	✓	✓	✓	✓	✓	✗	✓	✓	✓	*8*
Programs for monitoring inequities of public health services	✓	✓	✓	✓	✗	✗	✗	✗	✗	*4*
Policies and programs for children, women, PWD, LGBTQIA+, marginalised or indigenous groups	✓	✓	✓	✓	✓	✗	✓	✓	✓	*8*
Review of UHC programs to access innovative therapies	✗	✓	✗	✓	✗	✓	✗	✓	✓	*5*
(III) Leadership, accountability, and coordination										
Dedicated national NCD program	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Dedicated national CVD program	✓	✓	✓	✓	✗	✗	✗	✗	✓	*5*
Joint National and regional CVD coordination mechanisms	✗	✗	✓	✗	✗	✗	✗	✗	✗	*1*
Multi-ministry cooperation	✓	✓	✓	✓	✓	✓	✓	✓	✗	*8*
National CVD M&E program	✓	✓	✗	✓	✗	✗	✓	✓	✗	*5*
National NCD M&E program	✓	✓	✗	✓	✓	✓	✓	✓	✓	*8*
(IV) CVD Financing										
Dedicated budget to NCD programs	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Dedicated budget to CVD programs	✓	✓	✓	✓	✗	✗	✗	✗	✓	*5*
Universal coverage for screening for CVD	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Universal coverage for diagnostic tests and imaging for CVDs are financially covered	✓	✓	✓	✗	✓	✓	✓	✓	✓	*8*

National health policy addresses the following key CVD policy components	AUS	JPN	KOR	CHN	MYS	THA	IND	IDN	VNM	*No. of countries with this component*
Universal coverage for CVD Essential medicines	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Universal coverage for acute care for CVDs	✓	✓	✓	✓	✓	✓	✓	✓	✓	*3*
Universal coverage for hospitalization related to CVDs	✓	✓	✓	✓	✓	✓	✓	✓	✓	*3*
Universal coverage for outpatient consultation and follow-ups for CVDs	✓	✓	✓	✓	✓	✓	✓	✓	✓	*9*
Financing schemes for high-risk/existing patients	✓	✓	✓	✗	✗	✓	✗	✗	✗	*4*
Score for completeness of CVD strategy components (score out of 10)	*28*	*30*	*27*	*20*	*20*	*19*	*16*	*20*	*19*	

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