

HYPERTENSION IN THAILAND: BURDEN AND CHALLENGES IN ITS CONTROL

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Abbreviations

CKD	Chronic Kidney Disease
CSMBS	Civil Servant Medical Benefit Scheme
CVDs	Cardiovascular diseases
DALYs	Disability Adjusted Life Years
DBP	Diastolic Blood Pressure
GDP	Gross Domestic Product
IMR	Infant Mortality Rate
MoPH	Ministry of Public Health
NCDs	Noncommunicable diseases
NTCP	The National Tobacco Control Programme
SBP	Systolic Blood Pressure
SSB	Sugar-sweetened Beverages
SSS	Social Security Scheme
UCS	Universal Coverage Scheme
UN	The United Nations
USD	United States Dollar
WHO	World Health Organization
YLL	Years of Life Lost

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Abstract

Introduction: Hypertension is one of the leading noncommunicable diseases (NCDs) in Thailand. It can be considered a disease on its own, but it is also a risk factor, particularly for CVDs. This study aimed to review hypertension burden in Thailand, analyze its determinants, explore interventions from similar settings to reduce hypertension burden and recommend strategies to ministry of public health to help reduce the burden of hypertension in Thailand.

Method: This is a literature review of published scientific studies on hypertension, risk factors and intervention related to hypertension globally, in Asia and specifically in Thailand.

Result: The overall prevalence of hypertension is increasing in Thailand. Its burden is eminent with high morbidity, mortality, and socioeconomic burden. Contributing factors of hypertension include genetics, lifestyles, social and commercial factors. The Thai healthcare system is facing challenges in providing sustainable, accessible, patient-centered healthcare services for NCDs care with a limited health workforce, inefficient health information system, and increasing cost of mostly hospital oriented curative services. “Health-in-all-policies” approach is needed to effectively implement prevention. Strengthening primary healthcare system to enhance holistic and patient-centered healthcare services should be focused on. Redesigning provider payment methods, increasing health workforce, and health information system are also of importance.

Conclusion: High blood pressure and its cardiovascular complications induce a huge burden on individuals, communities, healthcare services and the country. The policymakers should implement efficient interventions for Thailand to be able to prevent new incidence of hypertension and provide sustainable care for hypertensive patients before it is too late.

Keywords: Hypertension, Noncommunicable diseases, burden, challenges, Thailand

Word count: 13,165 words (excluding tables, figures, Appendixes).

CHAPTER ONE: BACKGROUND INFORMATION ON THAILAND

1.1 Geographical profile

Thailand is in the middle of mainland Southeast Asia. It has a total size of 513,120 km² (198,120 sq mi) which is the 50th largest country in the world. The land border is 4,863 km (3,022 mi) bordering with Myanmar, Cambodia, Laos and Malaysia. The nation's axial position influences many aspects of Thailand's society and culture. It controls the only land route from Asia to Malaysia and Singapore. It has an exclusive economic zone of 299,397 km² (115,598 sq mi). The geography across country is varied by regions comprising of mountains to seas. The northern part is the area of highlands with Doi Inthanon in Chiangmai as the highest point of the country at 2,565 meters above sea level. The central region is mainly a flat valley with Chao Phraya River while the northeastern part is a plateau with Mekong river as the border. The southern part of the country starts from a narrow Kara Isthmus which expands to the peninsula with many big and small islands on Andaman Sea on the left and gulf of Thailand on the right. The physical setting of Thailand is the most pronounced factor for the diversity of its' economy and society (1)(2)(3)(4).

1.2 Demographic profile

In 2021, it was estimated that the total population of Thailand was at 66.17 million(5). Successful family planning programs were one of the main factors driving to the decline of population growth rate from 3.1% in 1960 to 0.4% in 2015 and to -0.6% in 2020. The working-age population is forecasted to drop by 11% of total population by 2040(6). In 2020, the actual proportion of working-age population accounts for 60% of total population. Life expectancy has been rising as the country becomes more developed. In 2020 the life expectancy for female and male was at 78.9 years and 72.4 years. respectively.

The birth rate is gradually declining to 10.7 births/1,000 population in 2020. The same trend is observed with death rate as it lowered to 8.3 deaths/1,000 population in 2020. As people live longer and the population growth is shrinking, Thailand is gradually becoming an "aging society" with about 12% of population aged 60 years or above in 2020 and the nation is about to become an "aged society" by 2025. The Fiscal Policy Office projected that older Thai adults aged 60 years or over will increase to 21.2% in 2025, and 25.2% in 2030. And as of 2016, it was estimated that around 94,000 employees were aged 60 years and above in the workforce (3)(5)(7)(8)(9).

Most of the population live in rural areas and are concentrated in central, northeastern and northern rice growing areas. Its urban population is principally in Bangkok and it's difficult to estimate the number as people tend to migrate from the rural areas into the city center for work but return home in fertile season even though the registry is at their hometown, they spend their lives mostly in the urban capital

areas. In 2020, there were 5.59 million people officially reported to be living in Bangkok but in reality the metropolitan is estimated to be populated by double this official figure.(10)

Literacy rate in Thailand is quite high and has been increasing in recent years as a result of a growing emphasis on education as the nation aims to develop its human resources as number one priority. In 2015, the literacy rate in Thailand was at 93% (5)

1.3 Socio-economic situation

Thailand has made an astounding economic and social development over the last four decades, making a step up from a low middle-income to an upper middle-income country during this period. Thus, Thailand has largely been referred to as a story of successful [economic](#) development with continued poverty reduction and economic growth. Poverty declined significantly during the last 30 years from 65.2% in 1988 to 9.85% in 2018. But the stagnant growth of household incomes and consumption in recent years resulted in a reversal in the progress of poverty reduction in Thailand. From 2015 to 2018, the poverty rate rose from 7.2% to 9.8% in Thailand, and the total population living in poverty increased from 4.85 million to more than 6.7 million. The surge in poverty in 2018 was occurring in all regions. In the Central and Northeast regions, the number of people experiencing poverty escalated by more than half a million in each region in the same period. And for the first time in 2017, the conflict-affected South became the region with the highest poverty rate.

In recent years, the economic growth decelerated from 4.2% in 2018 to 2.4% in 2019 due to a decrease of export demand because of trade tensions between US and China. There was a drop on public investments, and a drought affecting agricultural production. Some challenges remain to be tackled if Thailand's aim to be high-income country, such as education and skills matching for future generations. Inequality is another poignant problem in Thailand that continues to be on the rise: between 2015 and 2017 the average household consumption per capita accelerated, but the household consumption of the bottom 40% of the population decreased. And uneven education in the country remained as a Thai child can expect to obtain around 12.7 years of schooling before turning 18. But after adjustment for quality of learning, it only counts to 8.7 years of schooling, indicating a gap of 3 years.

The growth in Thailand was expected to continue to shrink in 2020 with the impact of COVID-19 pandemic due to country lockdowns and travel restriction which led to lower domestic consumption, a decline of tourism, and breakdown of supply chains. The result was increasing job losses, decreasing household welfare affecting mostly the poor and middle-class households threatening the economic growth gained just decades before. The decline of economic growth for Thailand in 2020 was among the sharpest declines in the East Asia and Pacific region. It is projected that the number of households living below \$5.5 per day, has doubled from 4.7 million in Q1 2020 to around 7.8 million in Q3 2020. The government has offered a fiscal package (6% of GDP) which was an unprecedented instrument sought to support vulnerable households

and companies. The World Bank is also ready to support Thai government's COVID-19 recovery programs.(3)(4)(12)

1.4 Health status

Life expectancy at birth in Thai male and female reported by WHO was 74 and 81 years in 2019 respectively. According to the Thai Ministry of Public Health, preventable maternal deaths have lessened from 26.70 per 100,000 live births in 2016 to 23.10 per 100,000 live births in 2020(13) . In 2020, Neonatal mortality rate was 4.91 per 1,000 live births. Infant Mortality Rate (IMR) was 7.41 per 1,000 live births. Mortality rate of children under 5 was 8.65 per 1,000 live births. Noncommunicable diseases (NCDs) is becoming a major challenge inducing high burden to the health system. 74% of Death in Thailand is from NCDs, stroke, heart disease, chronic lung disease and diabetes.(14)

1.5 Overview of the health system

The Ministry of Public Health (MoPH) is the national health authority on health policy. It is in charge of government medical services and public hospitals across the country (14). As of 2019, there are 927 hospitals under MoPH, 363 private hospitals and 25,615 private clinics(15). Citizens of Thailand have the right of access to healthcare services via the Universal healthcare Coverage Scheme (UCS) which was introduced in 2002 with the objective to provide coverage to the total Thai population. The scheme allows citizens to utilize healthcare in public hospitals where they are registered for 30 Thai baht (about \$1) per visit. The introduction of this coverage provides broad and equitable access to healthcare for the entire population which subsequently leads to higher healthcare expenses absorbed by the Thai government. The government's budget for UCS expanded ever since and reached 182 billion Thai Baht (\$6 billion) in 2019 (16).

Another main coverage scheme in Thailand established even before UCS is the Social Security Scheme (SSS) launched in 1990, covering private sector employees. The scheme is financed by three contributors: the government, the employer, and the employee. The three parties equally contribute 1.5% each of employee's payroll(17). There is also a specific healthcare scheme for government officials called Civil Servant Medical Benefit Scheme (CSMBS). This coverage is funded by general tax revenues and provides benefits to civil servants themselves, their life partners, their parents, and their children under 18 years of age. The scheme is considered as a fringe benefit for government officers who generally get low-paid salaries(17).

Voluntary health insurance is another choice of coverage for upper-middle to high income citizens. Even though the afore mentioned schemes cover most of the Thai citizens, some who can afford the voluntary insurance pay for private health insurance as this scheme also covers healthcare cost utilized in private hospitals and clinics.

1.6 Overview of the national expenditure on health

Over the past 20 years, the total amount of expenditure on health has dramatically increased in Thailand. According to the World Bank, in 2000, the health

expenditure per capita in Thailand was 62.3 US Dollar and in 2018, the spending was 275.9 US Dollar as shown in Table 1 (18) . The growth in amount of health expense is also reflected in a higher proportion of national Gross domestic product(GDP) expenditure on health.

There are several sources of health expenditure in Thailand which can be classified to 2 main categories: domestic government (public) and private sources. The governmental health spending consists of 3 schemes: The UCS, SSS and CSMBS. The UCS plays the major role as it covers all Thai citizen’s health expenses, apart from the ones who hold other schemes. Thus, after implementing the UCS, the health expenditure has critically changed. For the private sources, there are different sources of expenditure, such as voluntary health insurance contributions and out-of-pocket spending. The proportion of these sources is as shown in Figure 1.

The proportion of domestic general government health expenditure started at 55% in 2000 then surged up to 62.27% in 2002 when the universal coverage scheme had been implemented for the first time(19). Another dramatic growth in proportion of domestic government health expenditure was between 2005 and 2007 where the record rocketed from 64% to 75.61% in 2 years and subsequently fluctuated between 73% to 76% over the recent decade(19). On the other hand, as a result of the UCS, private expense on health dropped from 44.97% in 2001 to 23.39% in 2018 as shown in Figure 1 (20)(21).

The out-of-pocket expenditure decreased from nearly 35% in 2000 to 11% in 2018 which indicates better financial protection for Thai citizens as shown in Figure 2 (21)(22).

Table 1:Health expenditure in Thailand in 2018

Indicators	Thailand
Current health expenditure per capita (USD)	275.92
Current health expenditure (% of GDP)	3.79
Out-of-pocket expenditure per capita (USD)	30.38
Out-of-pocket expenditure (% of current health expenditure)	11.01
Domestic general government health expenditure per capita (USD)	210.45
Domestic general government health expenditure (% of current health expenditure)	76.27
Domestic general government health expenditure (% of general government expenditure)	15.04
Domestic private health expenditure per capita (USD)	64.54
Domestic private health expenditure (% of current health expenditure)	23.39
External health expenditure per capita (USD)	0.92
External health expenditure (% of current health expenditure)	0.34

Source: The World Bank (<https://data.worldbank.org/indicator/SH.XPD.CHEX.PC.CD?locations=TH>)

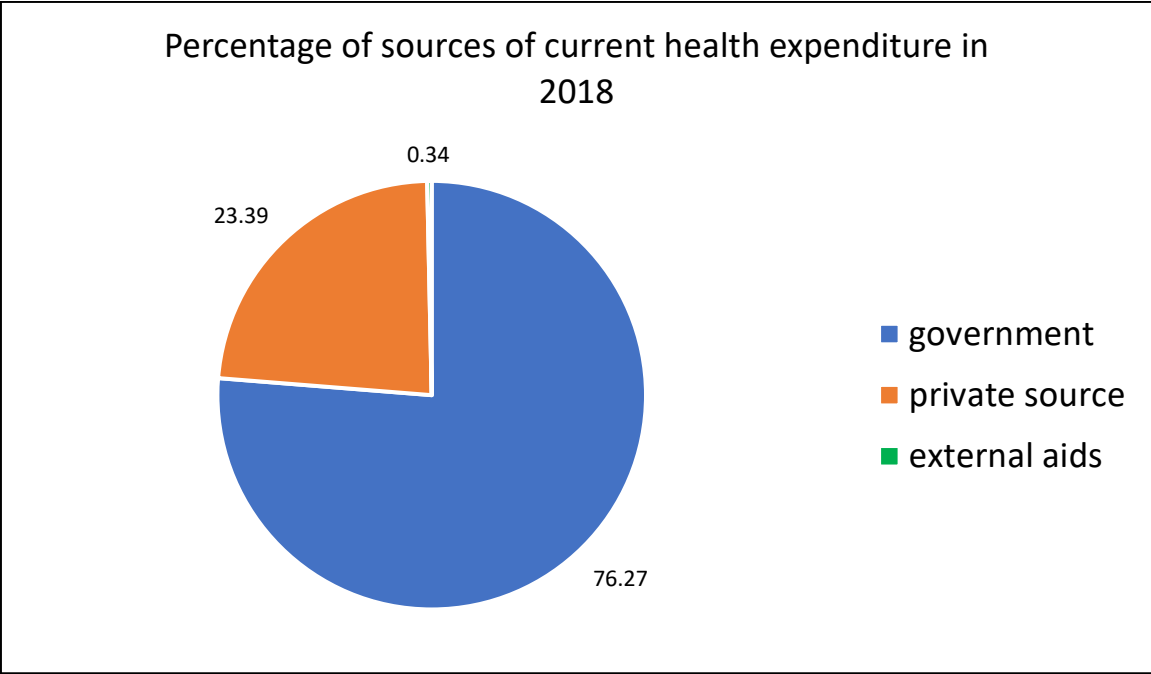
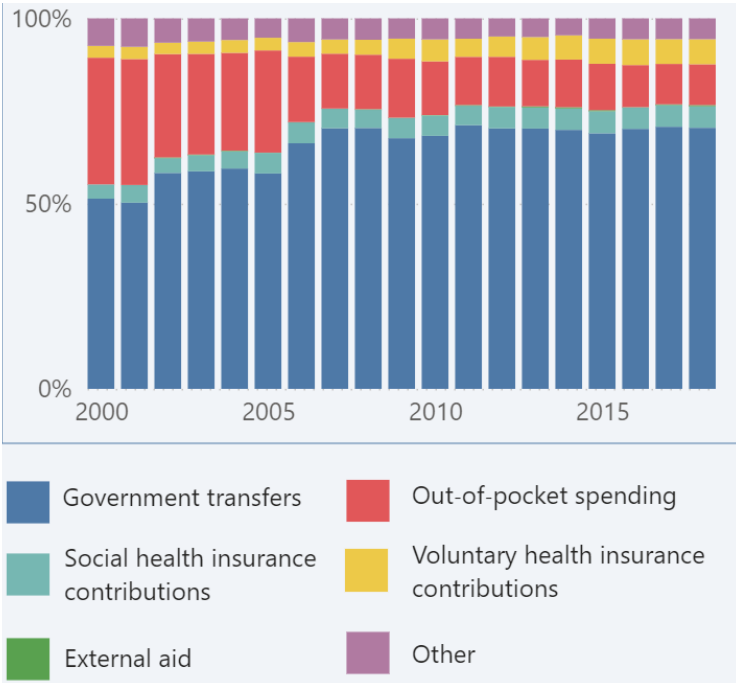


Figure 1: Percentage of sources of current health expenditure in 2018



Source: WHO Global health expenditure database (https://apps.who.int/nha/database/country_profile/Index/en)

Figure 2: Thailand sources of health expenditure during 2000 to 2018

CHAPTER TWO: PROBLEM STATEMENT AND METHODOLOGY

2.1 Problem statement

Hypertension is one of the leading noncommunicable diseases (NCDs) worldwide. Apart from being a cardiovascular disease in its own right, it is a key risk factor for other cardiovascular diseases: Lowering blood pressure has been proven to decrease the incidences of heart failure, heart attack, stroke and chronic kidney disease(24). World Health Organization (WHO) reported in 2021 that about 1.28 billion adults have hypertension with two-thirds living in low- and middle-income countries. Interestingly, almost half of the adults living with hypertension are unaware of their condition while less than half are diagnosed and treated with medications. Moreover, only about one-fifth of hypertensive patients have their blood pressure under control resulting in it being one of major causes of premature death globally(25). In the United States, more than half of their population are living with high blood pressure and only around 24% have their condition under control(26). In 2020, hypertension was a primary or contributing cause of death for more than six hundred thousand people in the United States(27). Not only that hypertension contributed to morbidity and mortality, but it is also a massive burden to healthcare system as it costed the United States \$131 billion each year, an average number from 2003-2014(28).

In Asia that is the most populous continent in the world, the prevalence of hypertension is between 15–35% in urban adult populations(29). In Southeast Asia specifically, the prevalence is on the rise for the past two decades. The non-age-standardized pooled prevalence estimate of hypertension for urban Southeast Asian was 33.82%(30). For Thailand, from the statistics of the Office of Policy and Strategy of the Permanent Secretary, Ministry of Public Health found that in 2018, there were 1,468,433 Thai citizens registered with hypertension with the registration rate of 2,245 per 100,000 population(31). Registered cases tend to underestimate the true prevalence. One study found that around one-fourth of Thai population are living with high blood pressure but only 44% knows that they are and receiving treatment(32). The numbers reflected that there are still gaps in prevention and treatment of hypertension in Thailand.

Although the true prevalence is not known, the trend is surely increasing each year with aging population and increase in risk factors such as physical inactivity, unhealthy diet, smoking as contributing factors(30). Reducing common modifiable risk factors for noncommunicable diseases and social determinants is among one of the objectives of WHO's global action plan to prevent and control NCDs(33). Countries around the world have implemented many interventions with the aim to induce their populations to make healthier choices, for example, increasing taxes on alcohol beverages and tobacco, reducing hours of sales of alcohol beverage, and enforcing drink-driving law(34). Nonetheless, the exposure to these risk factors among population remains high. Besides, another challenge is on effective diagnosis and treatment for individuals with high blood pressure as the data clearly show that registration rate is far

below the estimated prevalence rate, and that the majority of those who take medications still have uncontrolled blood pressure. To diagnose individuals with hypertension is not so straightforward as there is typically no signs nor symptoms in early stage of hypertension(25). An integrated approach focusing on primary prevention, raising awareness and more effective care for hypertensive patients with annual health checkup and risk factor screening may be initial steps toward . In most of the countries including Thailand, the focus is more on treatment not prevention and is often hospital oriented. This practice leads to a costly management and creates a burden towards healthcare financing and the successful Thai UHC.

With a goal provisioned by WHO saying that the global target of non-communicable diseases is reducing the prevalence of hypertension by 33% within 2030(25), it is clear that the policy makers have to introduce effective interventions that will enable the country to reach that target. Thus, this research aims to review hypertension burden in Thailand, analyze determinants of hypertension, explore interventions from similar settings to reduce hypertension burden and recommend strategies to ministry of public health to help reduce the burden of hypertension in Thailand.

2.2 Justification

While most of the studies on hypertension in Thailand focused mainly on the incidence and contributing factors, a comprehensive review to explore and analyze the burden and interventions to reduce the burden are very limited. This study aims to analyze burden, determinants and interventions and offer recommendations to policy makers to lessen the burden of hypertension in Thailand. As hypertension shares most of risk factors with NCDs in general, this review contributes to the overall problem of rising NCDs as well.

2.3 Research objective

2.3.1 General objective

To review data on the prevalence of hypertension in Thailand, analyze its determinants and explore interventions to help lower the burden of hypertension in Thailand.

2.3.2 Specific objective

- Describe the prevalence of hypertension in Thailand including the trends and the consequences of the burden on morbidity and mortality
- Analyze the various determinants of hypertension in Thailand and their trends
- Discuss current interventions in the country and their impact on lowering the burden

- Explore successful existing interventions from similar settings or global evidence, and their constraints
- Formulate recommendation for policy makers to help reduce burden of hypertension in Thailand

2.4 Methodology

This study was based on literature review of published scientific studies on hypertension, risk factors and intervention related to hypertension globally, in Asia and specifically in Thailand.

2.4.1 Search strategy

Literature search on the subject was done using PubMed, Google, Google Scholar search engines. Database of relevant sources such as WHO, The World bank, Ministry of Public Health of Thailand, Center of Diseases Control of Thailand, National Statistical Office Thailand, Thai Clinical Trials Registry were accessed to obtain publications, reports, factsheets, and policies.

2.4.2 Inclusion criteria

Only relevant literature published in English or Thai languages was used.

2.4.3 Key words

Key words were used in combination to obtain journal articles and other relevant documents which include hypertension, high blood pressure, noncommunicable diseases, Thailand, Asia, South East Asia, global, prevalence, risk factors, determinants, interventions, prevention, primary, secondary, tertiary, socioeconomic, commercial, social, lifestyle, morbidity, mortality, policies, impact, outcomes, burden, challenge, sugar-sweetened beverage, salt, physical activity, alcohol, tobacco, processed food, DALYs, YLLs, rehabilitation, success, strategy, challenge, stroke, ischemic heart disease, caretaker, direct cost, indirect cost, WHO, health system

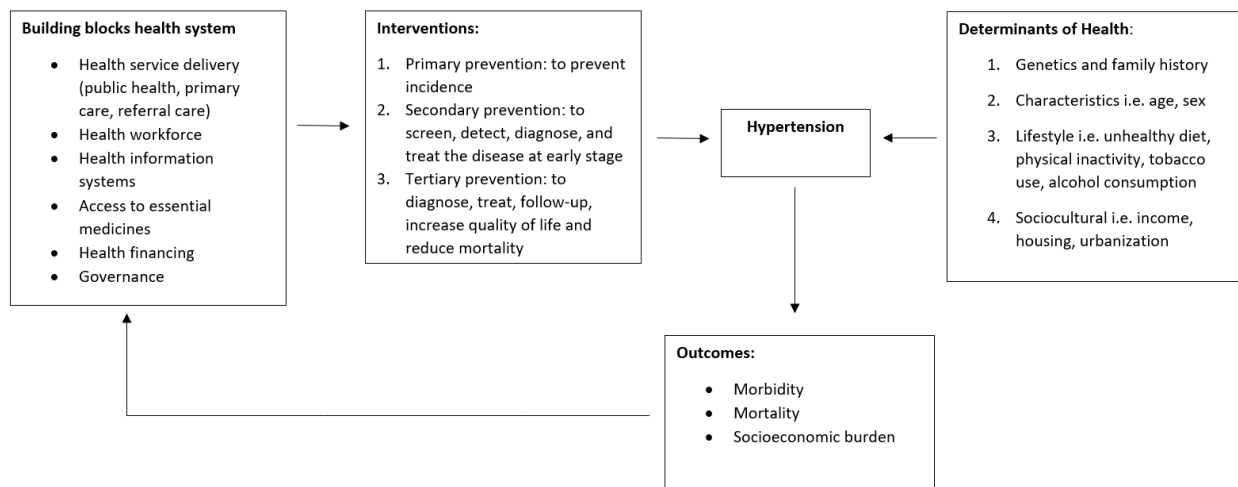
2.4.4 Ethical consideration

No ethical approval is needed. This is a literature review on secondary data which does not involve any primary data collection. The study causes no harm to any people or animal.

2.4.5 Limitation of the study

Data availability especially on statistics, prevalence rate, registration rate is not up to date. Reliability of various sources of data could not be guaranteed. There is limited number of references on intervention in Thailand. This is a literature review, association and causal relationship cannot be drawn from all studies referred to. Further study on the association of interventions and hypertension outcomes in Thailand could provide more information on how to address this burden.

2.5 Conceptual framework



Adapted from Witter T. et al.(35), Huang et al.(36), and WHO hypertension factsheet(25)

Figure 3: Conceptual framework

The conceptual framework used for the literature review is shown in figure 3. It was adapted from Witter T. et al, Huang et al., and WHO hypertension factsheet. The framework focuses on the impact of health system on interventions that can lead to hypertension and on various determinants of health which can result in hypertension. The outcomes of hypertension then affect healthy system. The details of the framework are as below:

1. Health system building blocks

According to WHO(37), six core components of health system are

I. Health service delivery

Service delivery which can apply to personal curative and preventive services and to public health services is key to any health system. It is a core factor to population health. A health system which has full accessibility, coverage, continuity, comprehensiveness, quality, and efficiency will drive towards a successful network of well-functioning health system.

II. Health workforce

Health worker density, the knowledge, skills, and motivation of healthcare workers are associated directly to population health outcomes. Health workforce includes all people whose primary intent is to enhance health including but not limited to physicians, nurses, dentists, pharmacists, public health workers, community health workers.

III. Health information systems

Key functions of systems which consist of data generation, compilation, analysis and synthesis, and communication and use is fundamental to decision-making in health systems.

IV. Access to essential medicines

Equitable access to efficacious, safe, cost-effective essential medicines, vaccines and technologies is vital in a well-functioning health system to improve population health outcome.

V. Health financing

Health financing is a key to maintain the functioning of health system with the purpose to guarantee access to healthcare to all individuals and to make funding available for healthcare providers' incentives and keep the system running effectively.

VI. Governance

Governance is vital in health system to ensure that healthcare frameworks and policies are effective, regulated and oversighted. Accountability in governance interconnect with various stakeholders in health including individuals, communities, governments and private organizations.

The six building blocks of health system have an impact on interventions and managements of hypertension, reflecting on access and efficiency of those interventions.

2. Interventions

I. Primary prevention

Intervening before occurrence of health effects via measures such as changing risk behaviors, banning substances which are associated with health condition, and redesigning social and physical environment to reduce risk factors and make healthy behavior more easy, all with the aim to reduce the burden of hypertension.

II. Secondary prevention

Focusing on screening to identify diseases at the earliest stages before signs and symptoms arise. And also, effective early treatment of diseases to prevent disease progression.

III. Tertiary prevention

Highlighting on effective treatment, and preventing complications or progress as diseases may not be cured. Offering health services to improve quality of life for patients to reduce mortality.

Interventions can affect either individuals' or broader social determinants of health and play an important role in preventing, screening, and treating hypertension.

3. Determinants of health

Determinants of health on blood pressure include:

I. Genetics and family history

Genetics is one of the unmodifiable risk factors for hypertension at least for the time being. Evidence shows that about 30% of high blood pressure is of a heritable trait.

II. Characteristics i.e. age, sex

Age and sex are the other unmodifiable risk factors for hypertension. The risk of developing high blood pressure is higher as people age and is more prevalent in males.

III. Lifestyle i.e. unhealthy diet, physical inactivity, tobacco use, alcohol consumption

Lifestyle is a major modifiable determinant for high blood pressure. Unhealthy diet such as high intake of salt, saturated fat and trans-fat, physical inactivity, tobacco use, alcohol consumption, obesity is among the risk factors of hypertension.

IV. Sociocultural i.e. income, housing, urbanization

Sociocultural determinants are also another key determinants for hypertension. Household income, housing, urbanization are shown to be associated with high blood pressure. This also involves redesigning the social and physical environment in such ways that healthy lifestyles become easier.

V. Commercial i.e. food price policy

Commercial factors involving food manufacturers, advertising companies, and pricing policy can determine individuals' blood pressure.

Determinants of health, either modifiable or nonmodifiable, then determine blood pressure of individuals. Some individuals have high blood pressure which then impact their health outcomes.

4. Outcomes

I. Morbidity

Hypertension is known to be the major risk factor for cardiovascular morbidity such as stroke, heart failure, heart attack, kidney failure. Uncontrolled hypertension and its complication can cause major impact on individuals and community.

II. Mortality

Complications of hypertension mentioned above can be fatal. Cardiovascular diseases (CVDs) are the leading cause of death worldwide and uncontrolled blood pressure is one of the risk factors for CVDs.

III. Socioeconomic burden

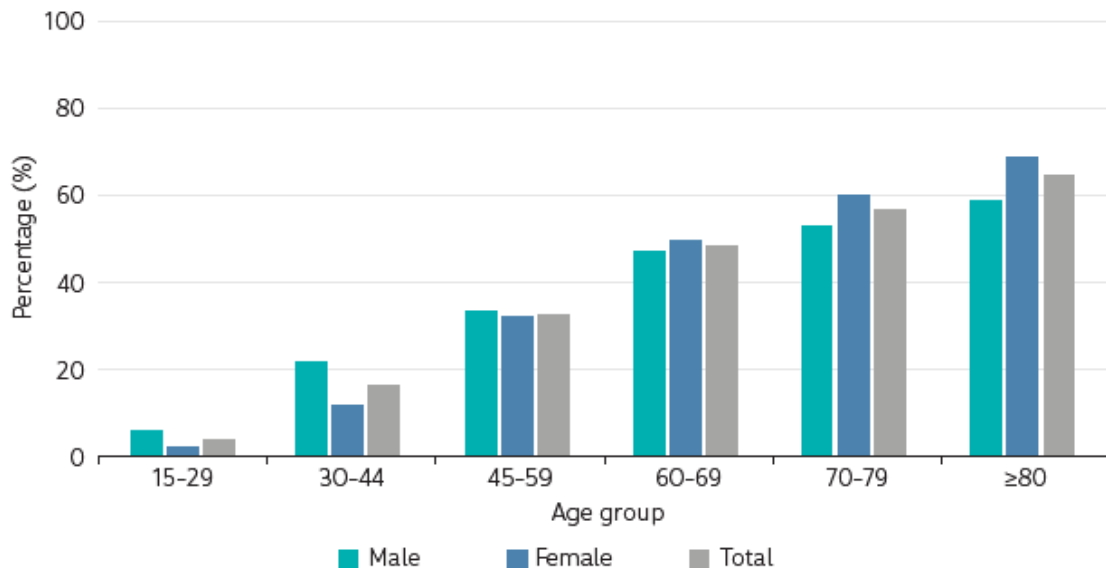
Individuals with hypertension must utilize healthcare services to control their blood pressure and prevent disease progression. The treatment and management services result in direct and indirect costs for individuals, households, communities, and healthcare systems.

These different outcomes of hypertension then reflect back on the whole health system to adjust and realign on its six building blocks.

CHAPTER THREE: PREVALENCE, BURDEN AND DETERMINANTS OF HYPERTENSION IN THAILAND

3.1 Prevalence of hypertension in Thailand

According to a study on burden of hypertension from 2003 to 2014, the prevalence of hypertension in Thailand is on a rise from 21% to 25%. Interestingly, the overall prevalence varied geographically with the highest prevalence in the Northern Region (33%) followed by the Southern Region (28%), the Central Region (23%), Bangkok (23%), and the Northeastern Region (21%) respectively. The prevalence was reported to be similar between urban and rural areas(38). A study in 2019 found that among those diagnosed with hypertension, the prevalence of uncontrolled hypertension was at 24.6%. It showed that about a quarter of Thai hypertensive patients are still unsuccessfully treated. Interestingly, geographical variation is also significant for the prevalence of uncontrolled hypertension. It consistently showed that the Northeastern Region has the lowest prevalence of hypertension and of uncontrolled blood pressure(39). The prevalence strongly increased with age especially in elderly age above 60 years old. The latest data in Thailand also revealed that hypertension is slightly more prevalent in male than female(38). (Figure 4.)



Source: National Health Examination Survey 2014

Figure 4: Prevalence of hypertension in Thailand in 2014

Even with repeated attempts of trying to figure out the true prevalence of hypertension, some studies were population based while others were from facility reported data, the prevalence rates studied above are arguably not a true prevalence but mere registered rates as they are sure to be underestimations. Evidence from a

study shows that around one-fourth of Thai population are living with high blood pressure but only 44% knows that they are and receiving treatment(32). WHO report also seconds the statement as it revealed that only half of those with hypertension are diagnosed in 2015. Besides, new incidence of hypertensive cases emerges at a rapid rate each year. A monthly data indicated that there are approximately 50,000 – 70,000 new diagnosed cases every month at ministry of public health facilities(38). There might be some limitations of studies to reveal the true prevalence but the trend is certainly on the rise with aging population. Thailand, apart from China, has the highest proportion of elderly people of any developing country in East Asia and Pacific. As of 2016, 11% of the Thai population (about 7.5 million people) are 65 years or older, compared to 5% in 1995. It is estimated that by 2040, 33% of Thai population (about 17 million people) will be 65 years or older(40). An increase in risk factors such as physical inactivity, unhealthy diet, smoking as contributing factors also play important roles in the rising trend of hypertension(30).

3.2 The burden of hypertension in Thailand

Hypertension is one of the leading NCDs globally and Thailand is no exception. It has significant impact on individuals, households, communities, and healthcare systems. The burden of hypertension in Thailand can be expressed in terms of morbidity and mortality, or in socioeconomic burden, and is discussed below.

3.2.1 Morbidity and Mortality

Hypertension is the biggest single contributor to the burden of diseases, morbidity, and mortality. It is a major cause of premature death worldwide(41). Hypertension significantly increases risks of developing brain, heart, kidney, and other diseases. Uncontrolled blood pressure can lead to complications such as heart attack, heart failure, arrhythmia, stroke, and kidney failure(25). Like the rest of the world, Thailand is facing a rising trend of NCDs. Hypertension is a dominant contributing factor for cardiovascular diseases (CVDs) and stroke. CVDs is also the leading cause of mortality in Thailand, responsible for about one-fourth of all deaths. In 2019, ischemic heart disease and stroke were the top two causes of deaths in Thailand(42). On top of that, the mortality from CVDs continue to increase for more than double in the last fifteen years while the overall mortality rate dropped by 6.1 per 100,000 population from 2001 – 2014(43). According to a report from the ministry of public health in 2019, there were a total of 58,681 deaths from CVDs or 7 deaths in every hour with the mortality rate of 90.34 per 100,000 population. In addition, there were a total of 18,079 deaths specifically from ischemic heart disease or 2 deaths per hour with the mortality rate of 27.83 per 100,000 population(44). From universal health coverage (UHC) database in 2020, incidence of stroke in individuals aged ≥ 15 years old was at 328 per 100,000 and the trend is rising in the last four years. It is unclear if the trend was due to aging population as data was not age stratified. The fatality rate of stroke across country was stable at around 10% in 2020, however, the rate increased to about 16% when follow-up 30 days after hospital discharge(45).

A study in 2013 showed that CVDs was accountable for 6.9% of overall disability-adjusted life years (DALYs) lost in male and was the top cause of DALYs lost in female with 8.2% of overall DALYs. Premature death amounted to 6.4 million years of life lost (YLLs) with CVDs and ischemic heart disease, ranked first and third cause, accounted for 10.6% and 7% of overall YLLs in female respectively. CVDs also accounted for 8.8% of overall YLLs in male following only after road traffic accidents(46). In 2014, Ischemic heart disease and stroke were accountable for more than 1.7 million DALYs lost, which accounted for almost a quarter of all DALYs(47). In 2019, high blood pressure was ranked at number four as a top risk that contributed to total number of DALYs(42). The burden of hypertension and its complication is highest in the elderly. DALYs for elderly aged ≥ 60 years old in Thailand was around 4.3 million in 2013. Stroke was the main cause of DALYs lost in both male and female accountable for 10.6% and 12% of total burden respectively. Specifically, in female, ischemic heart disease was accountable for 6% of total DALYs(46).

3.2.2 Socioeconomic burden

Hypertension and its complication of CVDs such as stroke causes huge socioeconomic burden to all parties. The UHC budget is strained due to the high costs of treating CVDs as it is estimated that a hospital care for acute stroke ranged from \$700 - \$1847 per case(48). It had a wide variation since the cost of care is influenced by patient characteristics, pathology, treatments, surgery, and length of stay. For individual hospitals, inpatient service cost of stroke is considerable. A study at 2 regional hospitals in northeastern and central region of Thailand in 2009 found that hospital cost for inpatient stroke care was around \$37 million in 9-month of study period per hospital. More than half of the cost was from material cost, followed by labor cost and capital cost respectively(49).

Indirect cost is another angle that is often overlooked. Hypertension and CVDs care required substantial involvement of family members or caretakers. A study in 2006 revealed that caretakers spend about 95 hours each month to take care of stroke patients. The main root of opportunity cost was unpaid work as those valuable hours can be equated to \$155 in monetary value(50).

A study in 2018 on the burden of stroke on caregivers at 1-year after discharge is quite alarming. It showed that 20% of caregivers were moderately to extremely burnt out physically and economically, while only 30% stated that they did not feel burdened taking care of the patients(51). It was revealed by another study that, care giving duration and functional status had both direct and indirect effects on caregiver burden(52).

To put things into perspective, the mean percentage of healthcare expenditure of gross domestic product around the world was at 9.8% in 2019, but it accounted for only 3.79% in Thailand(53). At current, Thailand's total expenditure budget in 2022 is approximately \$84 billion and less than 5% (about 4.7%) is prioritized for healthcare expenditure at \$4 billion(54). There is a clear gap and limitation on the monitoring on the use of budgets as no data is available on itemization of budgetary that has been prioritized. Although the exact data on expenditure for NCDs and hypertension is not available, a review showed that NCDs can put a huge financial burden on patients,

households and on UHC financial protection systems(55). It was also recognized as a challenge for health system in Thailand with the rising trend of NCDs and higher cost of interventions(56).

3.3 Determinants of hypertension in Thailand and their trends

Hypertension is one of the major modifiable contributing factors for CVDs, stroke, and end stage renal failure. Similarly, there are various determinants of hypertension including modifiable and unmodifiable factors which are explored in more details below.

3.3.1 Genetics and family history

Genetics is one of the unmodifiable risk factors for hypertension. Evidence shows that about 30% of high blood pressure is of heritable trait(25). Influence of family history on hypertension has been shown to be strongly related to an increased risk of developing hypertension by almost 2 folds. Not only hypertension, but family history is also a contributing factor of central obesity, obesity, and metabolic syndrome. The presence of family history, whether in siblings, parents or grandparents were significantly associated with higher risk of developing hypertension(57). Interestingly, significant differences between positive and negative family history with hypertension were also reflected in salt intake, body weight, and physical activity(58). The family history factor may reflect genetic component but also cultural habits and shared environment.

3.3.2 Characteristics

Characteristics such as age and sex are the other unmodifiable risk factors for hypertension. The risk of developing high blood pressure is higher as people age and is more prevalent in male. Other characteristics such as comorbidities are modifiable factors that can influence blood pressure.

Among Western population aged over 40 years old, systolic blood pressure (SBP) increases by about 7 mmHg every ten years(59). Much evidence supports that SBP is progressively rising with age, and by the time individuals reach their eighties, their average SBP would be around 140 mmHg. Diastolic blood pressure (DBP) also rises with age but with a slower rate than SBP. In contrast, DBP may even drop with age(60). The association of age and high blood pressure is imminent as data from many countries show that majority of hypertension patient pool comes from elderly. In United States, about 75% of population have hypertension by the age of 70. According to the latest national survey in Thailand in 2014, almost two-thirds of Thais have hypertension by the same age(38). In 2020, the United Nations (UN) estimated that there were around 13 million elderly in Thailand, that is one-fifth of total Thai population. UN projected that by 2050, there will be more than 22 million elderly in the country representing almost 36% of the entire population. Hypertension among other NCDs will surely be more prevalent as Thailand is transforming into an aging society at such a fast pace(61).

Sex is another characteristic which contributes to hypertension. Studies found that hypertension is more prevalent in male than female which is also the case in Thailand as shown from the latest hypertension national survey (26% in male, 24% in female)(38). However, international review and local data revealed that by the age of 50 years old, they tend to be more similar(62). The proportion of male and female in Thailand is almost equal. The percentage of male population is only 0.1% - 0.2% slightly higher than female at birth until the age of 40. Then the shift of proportion occurred as life expectancy is longer in female, at the age of 60, female population is larger than male for about 0.4%(63). With the stable sex ratio in Thai population, this characteristic would not be the main driver towards the increasing prevalence of hypertension in Thailand.

Comorbidities are highly associated with hypertension as high blood pressure is rarely present in isolation. Individuals with hypertension have higher chance of having other chronic conditions when compared to healthy individuals. In Korea, common comorbidities among individuals with hypertension were obesity (60.1%), dyslipidemia (57.6%), and high blood sugar (45.1%)(64). In China, the top four medical conditions of hypertension were coronary heart disease (22%), diabetes (16%), dyslipidemia (14%), and arteriosclerosis (13%)(65). Another study from Thailand showed that the chance of developing hypertension was associated with the presence of comorbidities such as dyslipidemia, diabetes, obesity, and kidney disease(38).

The prevalence of all comorbidities above is also increasing in Thailand. Every comorbidity is interrelated and can affect one another in complex ways. A national survey in 2015 revealed that about 26 million Thais were living with dyslipidemia and the rate is likely increasing each year(66). The same trend was found with other comorbidities; diabetes is more prevalent among Thai population in every age group with the overall prevalence rate of 8%(67). More than one-third of Thai adults are overweight (37.5%)(68). In Thailand, 11.6 million people (17.5%) currently have chronic kidney disease (CKD), with 5.7 million (8.6%) have advanced CKD (stages 3–5), and over 100,000 people required dialysis in 2017(69). These conditions are all contributing factors to CVDs. If on top of hypertension, individuals also have these comorbidities, the more challenging it becomes to control blood pressure which can lead to higher morbidity and mortality.

3.3.3 Lifestyle

Lifestyle is a major modifiable determinant for high blood pressure. Unhealthy diet such as high intake of salt, saturated fat, and trans-fat, physical inactivity, tobacco use, alcohol consumption is among the risk factors of hypertension.

Numerous studies have confirmed the established link between dietary salt intake and hypertension. It is related to water retention, an increase in systemic peripheral resistance, changes in endothelial function, alteration in the structure and function of large elastic arteries, modifications in sympathetic activity, and changes in the autonomic neuronal modulation of the cardiovascular system. Not only can a lower sodium intake lower blood pressure and the likelihood of developing hypertension, but it is also linked to a lower morbidity and mortality rate from CVDs(70). A nationwide population survey in 2020 revealed that Thai adults consumed roughly twice as much

sodium in their diets than is advised. Moreover, many studies clearly found an association between high salt intake and hypertension in Thai individuals(71)(72)(73). Several studies also found that intake of fast food, processed food, roasted and smoked food are linked with hypertension in Thai adolescents and adults(72)(73).

Dietary fat consumption has also been studied to be positively associated with hypertension. Among middle-aged and older women, a diet higher in saturated fats, monounsaturated fats, and trans fats was each linked to an increased risk of hypertension(74). However, dietary fat is not entirely harmful, it depends largely on which source of fat that one consumes. A study in Chinese adults showed that dietary fat from seafood, egg, milk, and dairy products, consumed at appropriate amount can be protective against high blood pressure. While dietary fat from fast food can lead to higher blood pressure in accordance with previous studies(75).

Recent systematic reviews showed that sugar-sweetened beverages (SBB) increase the chance of hypertension among children, adolescents, and adults. The consumption of SBB was associated with 1.67 mmHg increase in SBP among children and adolescents showing that consumers had 1.36 higher chance of developing hypertension(76)(77). Processed food is also another diet that many people love. In recent years, more studies emerged on its impact on health and blood pressure in particular. In a 2-year longitudinal study during 2012-2014 in Brazil, non-hypertensive individuals who consumed high ultra-processed foods had 23% higher risk of developing hypertension with odds ratio at 1.23(78). Same result was highlighted by a study from Spain with hazard ratio of 1.21(79).

According to a meta-analysis, there was a slight rise in SBP and DBP of 0.06 and 0.20 mmHg respectively, for every hour that self-reported sedentary activity increased. In addition, the incidence of hypertension increased by 2% for every hour that sedentary behavior increased (odds ratio: 1.02). Even though a physically active lifestyle is well established to improve general cardiometabolic health, including blood pressure control, a sizable and increasing segment of the world's population suffers from a lack of physical activity(80).

The finding that smoking causes a variety of harmful cardiovascular events and interacts with hypertension and dyslipidemia to increase the risk of CVDs is supported by a large body of research. Smoking is a significant cardiovascular risk factor. Increased oxidative stress brought on by cigarette use contributes to endothelial dysfunction and the emergence of hypertension. Smokers who already have high blood pressure are more prone to develop severe hypertension, including malignant and renovascular hypertension; this impact is probably caused by accelerated atherosclerosis(81). On a positive note, tobacco smokers in Thailand are slowly decreasing from 23% of total population in 2004 to 19% in 2017(82). The single most effective lifestyle change for the prevention of CVDs is quitting smoking.

Over 2 billion individuals consume alcohol worldwide. It is a frequently abused substance that can cause more than 200 illnesses, including hypertension. Alcohol affects blood pressure both immediately and over time. Debate is still ongoing on how to balance alcohol's health risks and cardiovascular benefits, the significance of various beverage varieties, how varied drinking habits affect cardiovascular morbidity and mortality, and the processes underlying ethanol's pressor effects. Evidence shown that outside of meals, drinking alcohol was linked to an increased risk of cardiovascular

disease and mortality from any cause(83). Additionally, it is widely known that excessive alcohol use raises the chance of developing hypertension. Reducing alcohol consumption lowers blood pressure in a dose-dependent pattern with threshold effect(84). The trend of alcohol consumption was stable for the last decades with the consumption rate at almost 30% of overall population aged over 15 years old. The rate varied greatly with gender as male consumed alcohol beverages more the female (46% and 11% respectively) (82). The target on reducing alcohol beverages intake will be another key factor to lessen the burden of hypertension.

3.3.4 Sociocultural

Sociocultural determinants are also another key determinant for hypertension. Household income, housing, urbanization are shown to be associated with high blood pressure. Individual and household income has been studied to associated with hypertension. Several studies highlighted that individuals with higher income tend to have a bigger chance of having hypertension in developing or low developed countries. This may be related to working environment as people with high incomes mostly work in executive fields which is more sedentary than manual workers with lower income(85). Gross domestic product of Thailand is gradually increasing each year, the economic growth also led to urbanization which in turn impacted lifestyles of Thais. Urbanization may create an unhealthy atmosphere where fast-food consumption, inactivity, and chronic stress are more frequent, which promotes the development of hypertension. Diagnosis and medication rates are much higher in urban areas than in rural areas, suggesting that urban areas provided better access to healthcare services(86). However, in more developed countries, the lower income groups have more risk for NCDs. Thus, as the country continue to develop, the trend in Thailand might change over time(87).

Stress has become a regular part of people's lives in the modern age of long-hour work weeks, tight deadlines, and unending committee meetings; Stress is one of the most common problems faced by people of every age. Stress can result in hypertension by repeatedly raising blood pressure and by stimulating the neurological system to create a lot of vasoconstricting hormones, which raise blood pressure. White coat hypertension, work stress, economic stress, social context, and mental distress are among the factors that affect blood pressure(88). More people are becoming more stressed in Thailand. The suicide rate is slowly increasing from 6 per 100,000 population to 7.3 per 100,000 population in the last few years(89).

3.3.5 Commercial

Commercial factors involving food manufacturers, advertising companies, and pricing policy which can affect individuals' blood pressure. Price is a key factor in food choices. Evidence supported that low-income individuals often choose less expensive and less healthy food than medium-income individuals. As nations advance, their food systems become more adept at offering more affordable access to both healthier and less healthy foods. The issue in less developed nations is that poor people also have access to inadequate food systems. It can be highly expensive to buy milk, fruits, and

vegetables in these places, which makes it more difficult to switch from nutrient-poor staple foods like rice, corn, and bread. In more developed nations, the issue is rather different: harmful calories have merely become a very reasonable choice. For processed foods, prices are primarily influenced by demand and the corresponding capacity of industrial sectors to create processed food at a reasonable cost. With a lot of demand and high manufacturing capacity, processed food and fast food are often cheaper than healthier food(90).

Because of the frantic pace of life in cities and the demand for faster and less expensive meals, fast food is still becoming more and more popular. In 2022, the fast food market is expected to be worth over \$690.80 billion bringing greater than 50% of sales in the entire restaurant industry. The magic tactics in food industry advertising to influence regulation, legislation, and public opinion are influential towards its reign in food industry. The total advertisement spending for fast food industry in 2019 was at about \$5 billion. Advertising obviously has a significant impact on the decisions we make, whether or not we are aware of it. Fast food representatives have frequently asserted that there are good and poor diets rather than good and bad foods, highlighting the fact that consumers are solely responsible for what they eat. It is a powerful message especially for the young generations where individual freedom and responsibility are cherished(91). Even though the trend of healthy diet is on the rise, fast food chains quickly adapted by introducing more health-friendly menus at a premium price. With addictive taste at affordable price, fast food industry is there to stay. It is important for individuals to wisely choose our diet to maintain healthy status and steer far from NCDs.

CHAPTER FOUR: CURRENT INTERVENTIONS & BEST BUYS

In this chapter, current interventions to tackle with high blood pressure in Thailand are discussed including their impact and challenges. The impact of Thai healthcare system on different building blocks is explored and successful interventions guided by WHO and other countries are examined here as well.

4.1 Current interventions in Thailand

The ministry of public health of Thailand incorporated the treatment of hypertension in the UHC benefit scheme in 2002 in response to the growing burden of NCDs. Everyone can receive free screening, diagnosis, medication, and laboratory monitoring for hypertension and related CVDs risk such as serum creatinine, fasting blood sugar, and electrolytes. Primary healthcare system for hypertension is completely covered by all three key insurance schemes in Thailand: UCS, SSS, CSMBS. Once a month, a special OPD for hypertension is conducted in health centers, frequently under the direction of a visiting doctor. At district hospitals, the outpatient department's NCD clinics are where hypertension is addressed. At provincial and regional hospitals, hypertension is managed every day at OPD of internal medicine clinics, family medicine clinics, or general practitioner clinics(38). Hypertension management at different hospital levels is shown in figure 5.

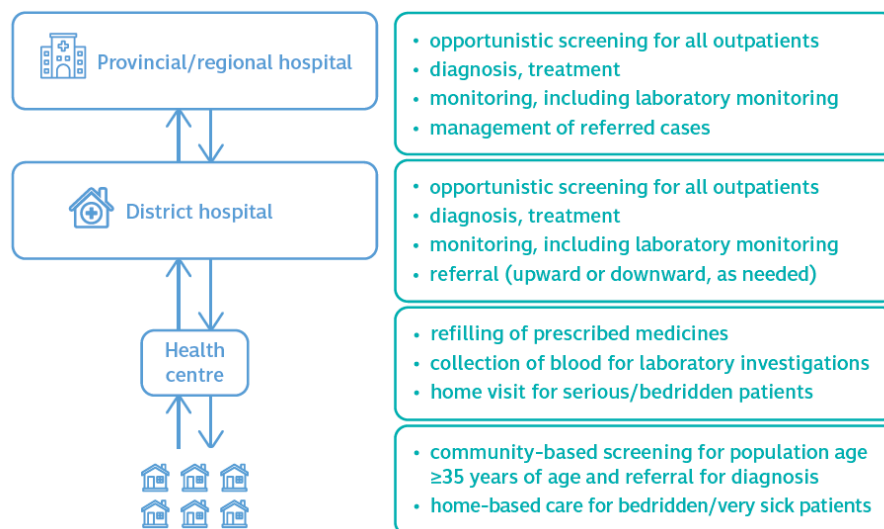


Figure 5 Hypertension management at different hospital levels in Thailand

4.1.1 Primary prevention

With the goal to reduce the prevalence of hypertension. The ministry of public health Thailand had launched many initiatives as primary prevention to make the public aware on the burden of NCDs, and to change their lifestyles to be ones which reflect healthier choices to decrease the likelihood of developing hypertension and NCDs.

The national sodium reduction policy has been implemented since 2016 and will be enforced to 2025 with action plan focusing on public awareness, surveillance, labelling, product reformulation, legislation, and research initiatives that promote the manufacture and consumption of foods with lower sodium contents in prioritized groups. The policy is essential to the country where the average sodium intake among population is more than double the recommended daily amount. The government has been using several strategies such as mandatory nutrient content labelling consumer knowledge and awareness campaign, nation-wide salt reduction campaign, promoting low salt products and food options, implementing monitoring tools to evaluate data on salt consumption trends(92).

For sugary drink, sugary food, the government has only started taking action on this factor about 2 years ago. The public health awareness campaign was initiated called “Let’s order less sweetened drinks”. The government collaborated with 10 major sugary drink cafes to promote the availability and exposure of less sweetened drinks. According to a survey last year, after about one year of implementing this plan, there were about 35% more Thais who ordered less sweetened drinks compared to a year before. Showing a good sign towards less sugary drinks and diet(93). For processed food, there is no policy or action plan to tackle this factor at the moment.

Thai government has spent more than a decade on reducing cigarette smoking. Increased tax and tobacco price has been implemented for almost 20 years. The total tax on cigarette is around 73.5% of retail price in 2016, but the rate hasn’t changed since 2008. The government also banned showing cigarette packages in retail stores, enforced a regulation for manufacturers to show health warnings on the packaging with pictorial and text or “plain packaging” covering 85% of the front and back packages. The attempt to eliminate exposure to secondhand smoking in all indoor public spaces, workplaces, and public transportation has been successful on making mandatory rules for smokers to smoke at only designated areas and will be fined if they break the rules. Complete compliance was achieved in government facilities, healthcare facilities, educational facilities, indoor offices, restaurants, cafes, bars and public transport. Comprehensive rules have also been enforced on governing sponsorship, market marketing, and indirect promotions of cigarette smoking. There was also a public awareness campaign on harmful outcomes of cigarette smoking between 2014 -2016 to target population(94).

Policies are also in place for the reduction of alcoholic beverages consumption. The enforcement on restrictions of the physical availability of retail alcohol is active by reducing the hours of sale to be only during lunch time and dinner time, and also restriction of sales on buddhist holidays. The government has adopted and implemented complete prohibitions or restrictions on alcohol advertisement across all medias. There is also an increased excise tax for alcoholic beverages of all kinds(94).

To tackling NCDs especially diabetes and hypertension, the government has implemented a community-wide initiative for physical activity education and promotion, including a media campaign via all media outlets including Facebook, website, television, radio, newspaper, using the influential power of celebrities and influencers. The key message of the campaign is for the public to be aware on the harm of physical inactivity and sedentary lifestyles and promote physical activity by spending at least 150 minutes per week having moderately active physical activity(95).

Apart from the behavioral side, the government and private sectors have key role in determining health status of the population. More and more people are realizing that individuals' actions are socially created and significantly affected by commercial determinants(96). Big corporates in Thailand often seem to have major influence on policy decision making on politics, health, social and economic structures.

“Healthy city” policy has been roughly explored by the government since 20 years ago to develop cities in Thailand to be more “health friendly” and more livable. The key concepts of the project included environmental sustainability, affordable housing, inclusive city, connectivity, safety, walkable cities, green public spaces(97). But until now, there is very little green space in major cities, the pedestrian walks are still unfriendly especially for the handicapped, limited public spaces for health activities such as cycling. The government will have to relook at the policy once more on how to make Thailand or at least key cities across regions the true “healthy cities”.

4.1.2 Secondary prevention

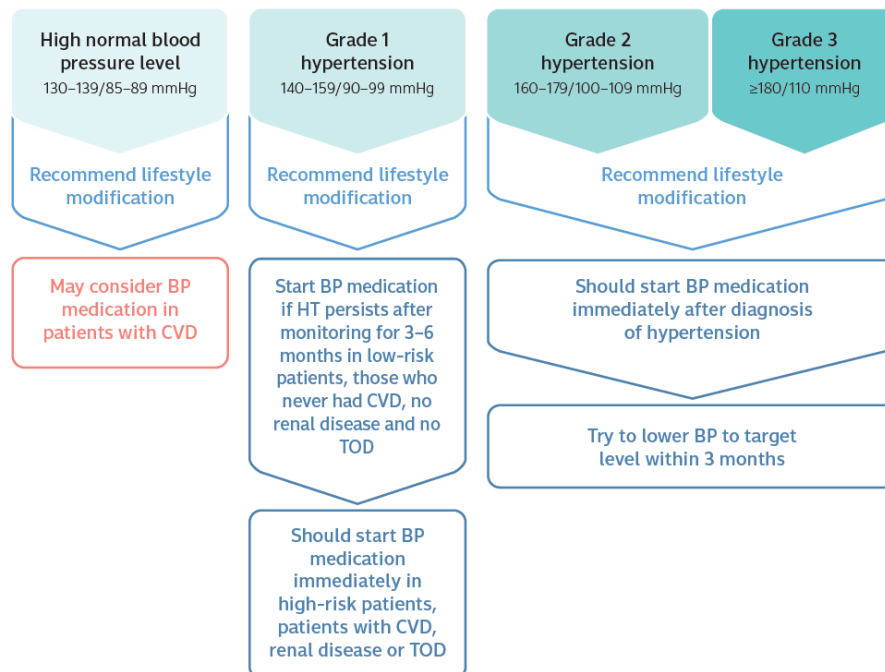
With the aim to focus on early screening and diagnosis, new cases of hypertension are detected through community-based screening, hospital-based screening, and self-referral. The essential bundle of fundamental healthcare services provided by UHC includes community-based screening for hypertension and other NCD risk factors.

A group of nurses organizes community-based hypertension screening annually mostly from October to March with the aid of community health volunteers at the subdistrict or village level. The target group for blood pressure screening is all individuals aged ≥ 35 years old without pre-existing diagnosis of hypertension. The screening rate of eligible population was reported at 88% in 2019 revealing that about one-fourth of the population were detected with high blood pressure. (1) Those with raised blood pressure were then referred to the health center or the district hospital for additional monitoring and diagnosis confirmation. The majority of these individuals do not, however, follow up to confirm the diagnosis partly because they may not have any symptom, flagging the gap in referral and follow up process.

For hospital-based screening, blood pressure measurement is the standard of care for all patients visiting any hospital whether public or private. According to health data center in 2017, about 60% of Thai adults visited public hospitals at least once during the year and only 6% of them did not have blood pressure records documented. From the data documented, raised blood pressure was found in approximately 30% from hospital-based screening. Interestingly, only 38% of individuals detected with high blood pressure were diagnosed with hypertension. Additionally, for those with more than two records of high blood pressure detected, 27% were still undiagnosed(98). These

results show that despite the fact that blood pressure monitoring is a routine of care, many missed opportunities occurred in the process of diagnosing hypertension.

Early treatment is also fundamental in secondary prevention as it is key to prevent disease progression. The treatment for hypertension is also covered by UCS, SSS, CSMB. Hypertension treatment in Thailand is in accordance with the Thai Clinical Practice Guideline (CPG) on Hypertension issued by the Thai Hypertension Society(99). The guideline is aligned with hypertension control guideline recommended by WHO(100). Even then, the application of CPG is up to the discretion of the doctors treating hypertension. The latest guideline was released in 2019 and summarized in figure 6.



BP = blood pressure, CVD = cardiovascular disease, TOD = target organ damage

Figure 6: Clinical practice guideline for hypertension in Thailand (2019)

According to the CPG, treatment should begin right away in the following situations. Firstly, the patient has a blood pressure reading $\geq 180/110$ mmHg. Secondly, the patient has been diagnosed with grade 2 hypertension (SBP 160-179 mmHg or DBP 100-109 mmHg). Thirdly, the patient has grade I hypertension (SBP 140-159 mmHg or DBP 90-99 mmHg) and has diabetes, renal disease, high CVD risk $>10\%$, target organ damage or prior CVDs. Laboratory screening for other NCDs is usually done at least every 6 months in patients with high blood pressure to assess for lipid profile, diabetes, and renal function(99). In practice, the integrated CVD risk is often overlooked and not been assessed in all patients, screening for other complications such as eye exam is also not stressed.

There are many challenges in treating hypertension. To begin with, there are variations in clinicians' judgement, clinical practice and medication prescription. A recent survey revealed that physicians often skip cardiovascular risk assessment at baseline and less than half of the patients were given the medication in accordance with the guidelines. Clinical inertia was also presented as only a quarter of patients had their medications adjusted when their blood pressure did not reach the target. (1) On the

patients’ side, the main issue is adherence to medication. A study in 2018 in rural area revealed that 80% of patients had low adherence to antihypertensive medications(101). Another study in 2019 also showed the same finding that only about 40% of patients had good adherence to antihypertensive drugs(102). The studies showed that even with early diagnosis and treatment, the issue remains on how to keep adherence rate up, to steer patients to keep their blood pressure under controlled in order to avoid complications such as stroke and ischemic heart diseases in the future.

Although with great effort from the government to set early screening interventions for early diagnosis and treatment, there are still gaps in the process that leave patients undetected and untreated which can then lead to higher morbidity and mortality when complications of hypertension like CVDs occurred.

4.1.3 Tertiary prevention

Tertiary prevention includes diagnosis, treatment and prevention of disease progression and complications. It also includes other medical services that help lessening morbidity and mortality from complications such as rehabilitation.

A continuing and effective hypertension treatment is essential to keep patients’ blood pressure under control and prevent complications. With the country’s focus on tackling NCDs, the hypertension treatment coverage has increased from 23.6% in 2004 to 50% in 2014, but only about 30% of patients had good control of blood pressure according to a population-based survey(103). High blood pressure in men (22.3%) is less well controlled than women (37.2%), and control is lowest among the youngest and oldest age groups. The coverage of diagnosis, treatment and control of hypertension by age group and by sex are shown in figure 7 & figure 8.

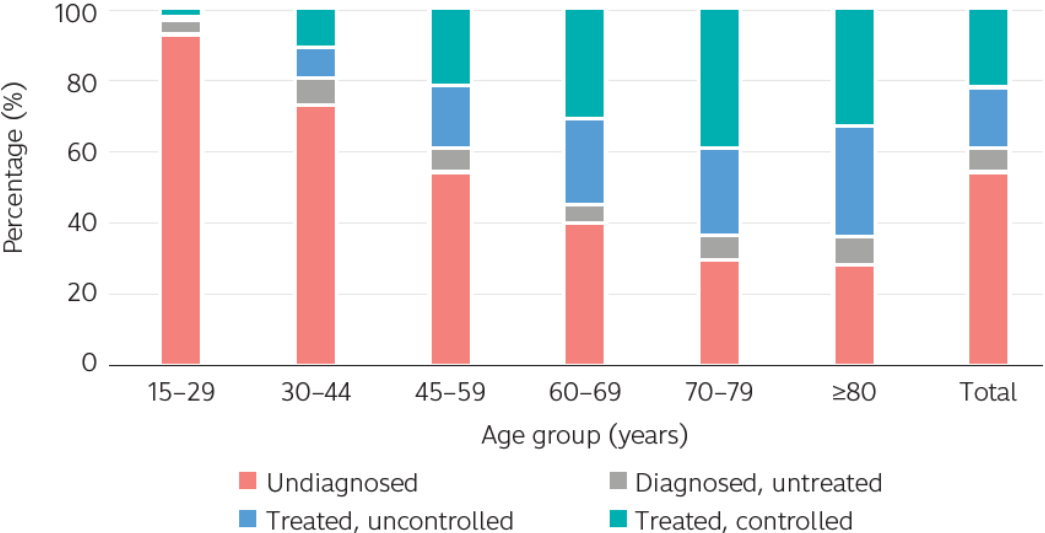


Figure 7: Coverage of diagnosis, treatment and control of hypertension among men stratified by age in 2014

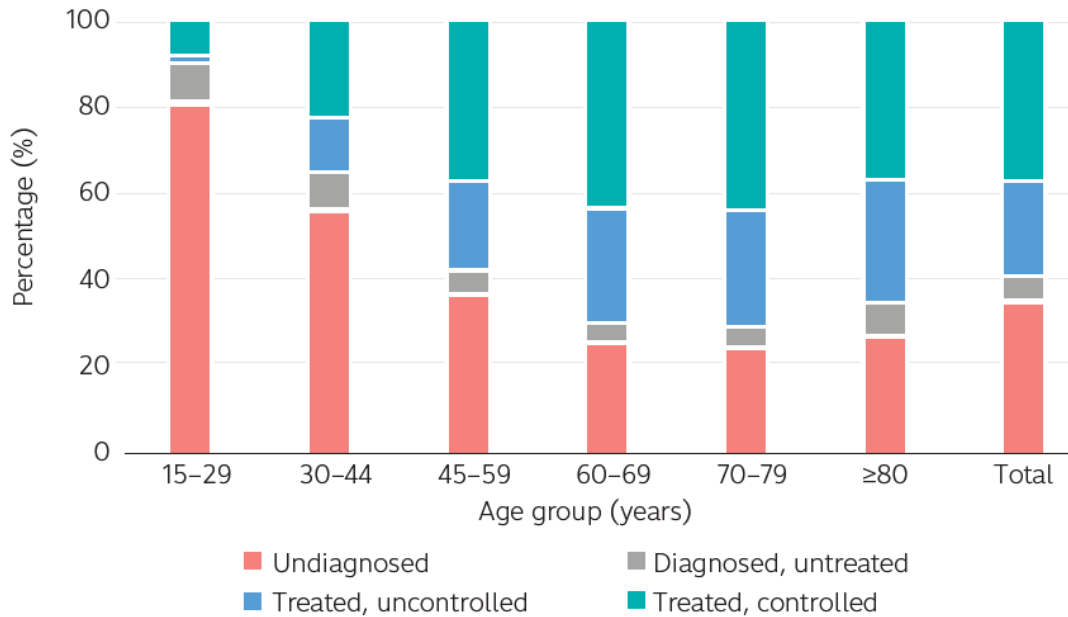


Figure 8: Coverage of diagnosis, treatment and control of hypertension among women stratified by age in 2014

In overall population, coverage of diagnosis and treatment increased with age. With poorest coverage of diagnosis among adolescents and young adults as the signs and symptoms may not show. The percentage of controlled hypertension among those treated is highest in 70-79 and 60-69 age groups as they are more likely to have doctor consultations with various health issues(103).

Complications of hypertension occurred less than 10% among patients with hypertension. In 2018, the most frequent complication was CVDs at about 7% and renal at around 1%. But this data was from a cross-sectional study with limitation as it did not explore complications as they gradually occurred with long-term follow up. The rate of complication then might be even higher(104). For those who already presented with complications, rehabilitation is important to decrease morbidity and mortality. In provincial and regional hospitals where rehabilitation ward is available, there is a protocol for attending physicians to consult rehabilitation department before patients' discharge in order to let patients learn how to do rehabilitation at their home for a faster recovery. The rehabilitation centers then make regular follow up to check patients' progress towards full recovery.

Rehabilitation centers in Thailand provide services in various approaches, self-rehabilitation, weekly sessions with therapists, and home therapists. However, the district hospitals or health centers in community often have no rehabilitation ward. There's a very high chance that patients may not receive rehabilitation after discharge due to limitation of healthcare services. Evidence supports the role of rehabilitation to reduce morbidity as a multi-center study in Thailand showed that followed one-year stroke outcome among those receiving rehabilitation. The study showed that rate of patients who need no caretakers was higher after rehabilitation at 25.5% at 12-month and 22.9% at 6-month. At the 1-year follow-up, the impairment level for about half of the patients had improved by at least one grade. Those with low functional score by the end

of the year were either had longer length of stay during the initial admission, later start of the rehabilitation program, or psychological depression(105).

The key challenge for rehabilitation program in Thailand is the access and coverage as only limited healthcare facilities are able to provide rehabilitation services. Even when patient got referral from health center to regional hospitals, there is a high chance of loss follow up due to a non-user-friendly processes and other indirect factors such as traveling time, transportation mean, and availability of caretakers.

4.1.4 Challenges in the healthcare system

In terms of governance, to address social determinants of health, a whole government approach or “health-in-all-policies” is needed. It must include multi-ministries in a multisectoral approach of which Thai government still lacks. The policies are usually driven by one ministry without cross-functional teams from other parties that should be involved. Commercial determinants and manufacturer factor are also crucial as influential companies may have hidden power to drive for or against any intervention recommended by the government. Majority of interventions implemented are too focused on changing individuals’ behavior while they did not provide any help to make those adaptation easier. There are too many “blaming-the-victims” strategies while only little effort is made in redesigning physical and social environments to promote lifestyle change.

Thai’s UHC reforms have been very successful in terms of providing access to healthcare services including access to medicines to all Thais through the three main healthcare schemes mentioned above. However, with the increasing trend of NCDs and the rise of service delivery cost. It is becoming a challenge as to how financing can still sustain the health system in the long or medium term(56).

Healthcare service delivery in Thailand is mostly hospital-based. With the higher burden of NCDs, the burden to the hospital and healthcare system increases. Thailand is still facing the challenge of providing effective primary healthcare to be more patient-oriented. The challenges for Thai primary healthcare system are limited health workforce and financial resources(106). That is why the access and coverage for certain specialized health programs or technologies is still limited to tertiary hospitals. Referral process from district hospital to secondary or tertiary hospitals is burdensome with no proper tracking system which often result in loss of follow-up. Continuity of care is a part of service that Thai health system needs to improve.

According to WHO, the UHC requires a health workforce density of approximately 4.45 health workers per 1000 people(107). The density of physicians, nurses, and midwives in Thailand was only at 4.1 per 1000 people in 2019(108). Health workforce is still very limited in numbers. What’s more is that a majority of healthcare professionals is mostly packed in major cities but not at the provincial or district level. This results in an inequality in access to healthcare as hypertension clinic might open only once a week at district level while in big cities like Bangkok, the clinics open every day. The role of multidisciplinary teams at primary care level is essential but with limited workforce and financial support, it is still another challenge on Thai health system.

Arguably one of the biggest challenges of Thai healthcare system is the health information system. The system for data registration, compilation and analysis is non-

user-friendly with lack of centralized system, health data is not interconnected, hard for the public to access and data communication still lacks holistic approach.

4.2 Best buys

The World Health Assembly endorsed WHO's Global Action Plan for the Prevention and Control of NCDs 2013–2020 in 2013 offering best buys or policy options and interventions to help countries to tackle with NCDs. WHO's interventions were analyzed for feasibility, cost effectiveness, and non-financial considerations. The best buys from WHO and also successful intervention from other countries are discussed as below.

4.2.1 Primary prevention

For tobacco use, the most cost-effective best buys are implementing health warnings on tobacco packages, increasing excise taxes and prices on all tobacco products, enforcing bans on tobacco promotion and advertising, implementing public awareness campaign on the harms of tobacco, and banishing second-hand tobacco smoke in all public transport, indoor spaces and public places. Other recommendations also include offering affordable, efficient, and population-wide assistance to all individuals who want to stop tobacco use, providing tobacco cessation services via mobile phones, banning cross-border tobacco promotion, minimizing illicit trade in tobacco products(34). Several reviews were done to examine the real-world effectiveness of these interventions in the United States of America and the United Kingdom. The studies found that over the past 20 years, there has not been a continuous upward trend in the population cessation rate in those countries. The authors also highlighted that the field of cessation has largely failed to research ways to encourage more smokers to try to stop and to try more frequently since it has focused so much on creating and advertising interventions to increase smokers' chances of success(109)(110).

Interesting interventions from Australia starts early as school-based interventions including information-giving curricula, social theory based learning, and multi-modal programs involving parents and communities(111). The National Tobacco Control Programme (NTCP) was established in Singapore to implement smoking prevention programs to lower smoking rates. Taxation has been shown locally to effectively decrease tobacco use with tax increase regularly since 1987. They also have strong partnerships with external stakeholders such as private workplaces, youth organizations, educational institutions, healthcare professionals, religious groups, to promote a smoke-free lifestyle. The government offers consultation to assist workplaces in establishing smoking cessation programs. One essential factor in Singaporean government's strategy is to offer smoking cessation services which are accessible and affordable(112).

The best buys to decrease alcoholic beverages consumption include increasing excise taxes, banning alcohol advertising, enforcing restriction on the beverages' physical availability, enforcing drink-driving laws, providing brief psychosocial intervention for individuals with hazardous alcohol use. Other interventions consist of

having regular reviews of retailed alcohol prices, reducing density of retail outlets, providing prevention and treatment for alcohol use and comorbid conditions in healthcare and social services and providing consumer information on the label to indicate the harm of alcohol(34). Effectiveness of reducing alcohol consumption was shown especially with interventions in settings with healthcare professionals for example, nurses or doctors(113). In contrast, contradicting evidence was presented on the effectiveness of some interventions such as brief intervention, community level intervention. A study from Sweden supported the previous claim and pointed out that the challenge on measuring effectiveness of interventions was the follow-up period that needed to be long enough to show the behavioral change(114). In England, interventions such as prenatal visit in selective groups aimed to tackle the root cause of the problem to provide positive, warm, connected, and disciplined environment for children so that the children will not need to depend on tobacco with the warm and connected family(115).

To tackle unhealthy diet factor, the cost-effective best buys recommended by WHO are reducing salt intake by setting the target levels for salt amount in food, reformulating food products to contain less, reducing salt intake with supportive environment in public areas such as schools, workplaces and hospitals for lower sodium options, promoting salt intake behavior change via mass media projects, providing clear label of sodium amount on food packages, eliminating industrial trans-fats by introducing legislation to ban their use in the food chain, reducing sugar consumption through taxation on sugar-sweetened beverages. Other supportive methods are supporting exclusive breastfeeding for the first 6 months of life, implementing subsidies to raise the intake of vegetables and fruits, replacing saturated fats and trans-fats by unsaturated fats via reformulation, labelling, limiting package size to reduce energy intake and the risk of obesity, implementing nutrition education and counselling in various settings, implementing nutrition labelling to reduce total energy intake, sodium, fats, and sugars. implementing media campaign on healthy diets to reduce the intake of salt, sugars, total fat, saturated and promote the intake of fruits and vegetables(34). Potential strategies proposed by experts included offering affordable and nutritious meal kits, increasing affordability for fundamental ingredients i.e. cooking oil, meat, egg, increasing availability of affordable, nutritious hand prepared food(116).

Several strategies are suggested by WHO to reduce physical inactivity including implementing community-wide public awareness and education campaigns for physical activity which include media campaigns combined with community based education, motivational programs focused at encouraging behavioral change of physical activity levels, providing physical activity counselling and referral in primary health care services via brief intervention, implementing school programs that include quality physical education, availability of adequate facilities, providing safe and convenient access to quality public open space and infrastructure to support walking and cycling, making sure that the main components of residential density such as connected street networks with sidewalks, easy access to a variety of attractions, and accessibility to public transportation are all included in macro-level urban planning, and promoting of physical activity through organized programs, sports and events(34).

The Netherlands ranked first as the most physically active nation in 2021 as reported by Ipsos reporting almost 2 hours a day of physical activity among adults(117).

The policies enforced by the Dutch government could be valuable examples for others. Some of the key strategies are firstly with the National Sports Agreement, with the goal for every Dutch individual, regardless of age, physical or mental health, ethnic background, sexual orientation, or social background, to enjoy sports and exercise throughout their lifetime. Secondly, the National Prevention Agreement, by making investments in bicycle incentive programs and cycling infrastructure, it encourages a physically active lifestyle. Increasing the proportion of people who adhere to the recommended levels of physical activity is a long-term goal. Thirdly, Tour de Force Bike agenda, governments, corporations, social organizations, and educational institutions are all partners in this initiative to encourage people to cycle regularly and an annual report is published including a quantitative review of bicycle use and infrastructure(118).

4.2.2 Secondary prevention

Screening and early detection are important interventions to prevent burden of disease. Mostly, diagnosis of hypertension is made in a hospital-based setting. Strengthening the primary healthcare system to promote, screen and early treat the disease is a recommended strategy for every country. These interventions should be done effectively at the community level for easier access and also to lower the cost of care as utilization of hospital-focused services is expensive. With the rise of NCDs, if the primary healthcare system is not strong, much burden will be felt at hospital settings and could impact the overall healthcare system(34). For hypertension, not only the detection of high blood pressure is important, but detecting the sign and symptoms of CVDs such as ischemic heart disease, heart failure and treating these conditions early is also of focus

4.2.3 Tertiary prevention

For treatment and control of high blood pressure, WHO suggested that people who have had a heart attack or stroke and those at high risk (30%) and moderate to high risk (20%) of both fatal and non-fatal cardiovascular events during the following 10 years should receive drug therapy to control hypertension using a total (integrated) risk strategy, as well as counseling(34). Other effective interventions include treatment of new cases of myocardial infarction using aspirin and clopidogrel, primary percutaneous coronary interventions (PCI), initially administered in a hospital setting, with follow-up provided by primary healthcare institutions at a coverage rate of 95%, continued lifestyle interventions such as increased physical activity, lower sodium intake, maintain body weight(34).

Rehabilitation is also a key part for tertiary prevention which added on from the continued drug therapy in secondary prevention. Post myocardial infarction rehabilitation, care of acute stroke and rehabilitation in stroke units are of some examples(34). The guidelines from developed countries like The United States issued by American Heart Association and American Stroke Association clearly endorsed the need for stroke patients to get an early, systematic, interdisciplinary approach to their initial stroke rehabilitation. The rehabilitation should start since patients are admitted by providing inpatient rehabilitation for those who have sustained impairments. Moreover,

the organized care should continue in home and community settings for a long-term care of several years involving non-professional and also professional caregivers(119). This type of care is mostly hospital-oriented, it is essential for government to have more patient-centered approaches, to provide care that is closer to their home. This will allow for easier access to care with regular follow up without burdening the hospital system

4.2.4 Policy options

To implement successful interventions and best buys recommended above, the government and policy makers must have clear vision and guidance. WHO's recommendations for policy options include, raising political and public awareness, understanding and practice on prevention and control of NCDs, engaging community and the private sector as appropriate and building up international cooperation, prioritizing and increasing budgetary allocations for NCD prevention and control as necessary, creating and carrying out a nationwide NCDs research agenda with appropriate budgetary allocation, strengthening human resources to tackle NCDs in healthcare services and research, establishing and strengthening a comprehensive surveillance system for NCDs with reliable registrations on related factors and events and a continuing data update, monitoring and national response, and integrating NCDs surveillance and monitoring into national health information systems(34).

Most importantly, to tackle health issues, the government should have "health-in-all-policies" approach meaning that all the ministries must come together as one and working cross functionally for effective government interventions. The approach requires a better universal health care, health-care financing, and urban infrastructure, advances in sanitation, mother and child nutrition, agriculture, employment, transportation, and reductions in alcohol misuse, tobacco use, consumption of unhealthy foods, illiteracy, and poverty(120).

Regarding the healthcare system, in a situation where healthcare services is mainly hospital-based, it is important to strengthen the primary care health system to provide holistic healthcare approach to individuals, to be more "closer to home" and accessible and patient-centered. Moreover, it is crucial to transform the healthcare system such that preventative care is prioritized over curative care(120).

The government has to focus more on policies to enhance social and physical environment which help promoting healthy lifestyle. Technology-based strategies have also shown benefits in patient empowerment, enhancing lifestyle modification, increasing adherence to treatment and promoting better treatment outcome, targeted or individualized interventions may be needed in some high-risk patients(120).

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

NCDs are the leading cause of mortality in Thailand. High blood pressure and its cardiovascular complications induce a huge burden on individuals, communities, healthcare services and the country as a whole. Hypertension can be considered a disease on its own but it is also a risk factor particularly for CVDs. It is the leading single risk factor for CVDs including ischemic heart disease and stroke. What's more is that high blood pressure is rarely presented in isolation, by focusing on hypertension, it automatically includes also the contributing factors such as unhealthy diet, and smoking. Hypertension is also a hidden problem as more than half of population is not aware of it or ineffectively treated. NCDs, hypertension, and CVDs are interconnected and that is why this study focused on all three aspects apart from high blood pressure alone.

The overall prevalence of hypertension is on an increasing trend with latest data showing that about one-fourth of adult population are living with high blood pressure. As people age, the higher the chance for developing hypertension. And as Thailand is an aging society expecting that one-third of the entire nation will be the elderly in the next 20 years, an increase of prevalence and burden of hypertension will surely follow.

Hypertension and its complications are among the main contributors to morbidity and mortality in Thailand. CVDs, the major complication of high blood pressure, are the leading cause of death of Thais accountable for one-fourth of all mortality with ischemic heart and stroke as the top two contributing conditions. On morbidity, CVDs was the main cause of DALYs lost accountable for about 12% of total DALYs.

Socioeconomic burden is another important aspect especially for the healthcare system and policy makers. The direct cost per case of treating CVDs is roughly twice the average monthly salary for Thais. Indirect cost and burden to the patients' family members and caregivers are substantial but research is still very limited in this aspect.

There are various contributing factors for high blood pressure, NCDs and CVDs. Genetic component predefines the heritable trait of hypertension, furthermore, the shared environment and cultural habits shared within the household is also key. In Thailand male has a higher chance of having high blood pressure than female. Evidence also supports that the older we get, the more likely we develop hypertension as SBP increases 7 mmHg every 10 years. Having other comorbidities is also highly associated with high blood pressure as it barely presents in isolation. In Thailand, more people are having comorbidities such as overweight, obesity, dyslipidemia, diabetes.

Lifestyle is essential in determining one's health status. What's more is that it is modifiable. Many studies supported that the food one chooses to consume reflects their health. The high intake of salt, sugar-sweetened beverages, saturated fat, trans fat, and processed food is associated with high blood pressure and an increased risk of developing NCDs. The use of tobacco products and alcohol beverage consumption has also been linked to many hazardous health outcomes including hypertension for decades. A sedentary lifestyle or physical inactivity is another lifestyle trait which associated with NCDs. These unhealthy lifestyles seemed to be on a rise in Thailand highlighting the need for better primary prevention in the country.

Sociocultural and commercial determinants are often overlooked but play important contributing part to the risk of high blood pressure. Household income, housing, infrastructure, environment, urbanization, food price, food or product advertisement all contributed to our decision to choose the lifestyle that makes our health conditions better or worse.

In Thailand, patients are covered by the three main healthcare schemes which are UHC, SS, and CSMBS allowing access to healthcare services to most of Thai citizens. For primary prevention, there are many policies implement by the government with the aim to promote healthier lifestyle to Thais such as interventions to lower salt and unhealthy diet intake, increase physical activity, and stop tobacco use. However, the interventions are often of “blaming-the-victims” approaches without government interventions on social and physical environment to support lifestyle change on the population.

There are also challenges in the capacity of health workforce, health financing and government policy in such a way that recommendations and interventions are often driven by a single ministry without cross-functional support from interrelated ministries and key external stakeholders.

The Healthcare system in Thailand is mostly hospital-based and treatment-focused, advanced specific care or health technology is only available at tertiary hospital with limited access and capacity. Health information system in Thailand is another pain point that the government needs to urgently fix. There is a lack of a user-friendly centralized system to track the health data of Thais which then leads to lack of real-time health analysis at population level and appropriate interventions.

The Thai government has to redefine strategies to tackle NCDs and hypertension more effectively to promote prevention and tackle NCDs for sustainable healthcare.

5.2 Recommendations

5.2.1 Policy options

- “Health-in-all-policies” approach is needed to be effectively implemented immediately by The Thai government. All ministries, related key external stakeholders including key private sectors must come together to tackle health issues including NCDs and hypertension.
- Strengthen primary healthcare system to enhance holistic and patient-centered healthcare services. Decentralized healthcare system that is hospital-based to a community-based and provide services at individuals’ local community to provide sustainable care.
- Redefine health insurance schemes to create provider payment methods that favor integrated and continuous approach to sustainable hypertension and NCDs care
- Improve health information system to be able to track health data of Thais at population level with timely analysis and appropriate communication to further provide evidence and insight for appropriate interventions.

- Increase health workforce and promote appropriate and fair incentives for the workforce to be available at district level without clustering in only major cities.
- Promote prevention mindsets, strategies, and interventions to alleviate rising burden to healthcare system.
- Integrate technology into healthcare at appropriateness for better prevention, adherence to treatment, and treatment outcome.

5.2.2 Primary prevention

- Enhance social and physical environment such as bike lanes, safe and convenient pedestrian walks, and more green spaces, to shape healthy community that allows individuals to adapt easily to healthy lifestyle.
- Introduce impactful and lasting health awareness campaigns on NCDs and promote healthy lifestyles using digital media platforms such as Instagram, Facebook, Twitter, and Tiktok with influencers in different fields and regions to expand the reach to entire population.
- Raise public awareness of the harm of unhealthy diet, especially on sugar-sweetened beverages and processed food which is less recognized in the country.
- Implement policies to reduce consumption of sugar-sweetened beverages e.g. introducing sugar tax, enforcement of the maximum sugar level allowed in a drink.
- Offer accessible and affordable or application-based program to stop tobacco use or alcoholic beverages consumption.

5.2.3 Secondary prevention

- Enhance screening system and trackable records for individuals to follow health trends and monitor for any early signs or symptoms of diseases
- Close the follow-up and/or referral loopholes in individuals with detected high blood pressure with health information system that can link to individuals' usual hospitals or district level clinic for nurses or health volunteers to make a follow-up visit.
- Improve healthcare service at district level for early treatment of hypertension
- Implement mandatory annual CVDs and other complications screening for all patients with high blood pressure annually.

5.2.4 Tertiary prevention

- Improve efficiency and effectiveness of hypertension clinic including treatment counseling, lifestyle adaptation, holistic care, and family counseling to improve medication adherence and treatment outcome.
- Focus on continuity of treatment with regular follow-up and check-ups for other NCDs and other diseases.
- Strengthen referral system to tertiary healthcare facilities to ensure no loss to follow-up during the process.
- Increase coverage and availability of rehabilitation centers especially in upcountry.

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