UNITED NATIONS
THAILAND

UN INTERAGENCY
TASK FORCE ON NCDs

PREVENTION AND CONTROL OF NONCOMMUNICABLE DISEASES IN

THAILAND

The case for investment

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Acknowledgements

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Executive summary

Noncommunicable diseases (NCDs) are the number one killer in Thailand. The four main NCDs — cancer, cardiovascular diseases, diabetes and chronic obstructive pulmonary disease (COPD) — claim 400 000 lives annually or more than 1000 lives every day, and are responsible for 74% of all deaths in the country. Premature deaths and reduced or lost productivity when employees cannot fully function in ("presenteeism") or leave the workplace (absenteeism) because they have an NCD are known to result in an economic burden, but exact numbers were not available.

This study has shown that NCDs cost the Thai economy THB 1.6 trillion annually, equivalent to 9.7% of its 2019 gross domestic product (GDP). These costs include THB 139 billion to treat NCDs and THB 1.5 trillion in lost productive capacity due to absenteeism, "presenteeism" or early withdrawal from the labour force due to premature death or disability. The productivity losses due to NCDs account for 91% of all NCD-related costs. NCDs thus negatively affect socioeconomic development and the long-term fiscal sustainability of Government and public services.

As elsewhere, NCDs in Thailand are exacerbated by COVID-19 and vice versa. NCDs and their behavioural, environmental, and metabolic[1] risk factors increase susceptibility to COVID-19 infection and the likelihood of severe and fatal outcomes to various degrees. NCDs therefore contribute to the overwhelming strain of the pandemic on health systems, which, in turn, threatens to disrupt access to NCD services.

This report provides evidence that Thailand would benefit from investing in four policy intervention packages that reduce exposure to behavioural risk factors (tobacco use, harmful use of alcohol, unhealthy diet and physical inactivity) and in key clinical interventions for the four most prevalent NCDs. The findings show that investment in NCDs is a matter of urgency and will ensure significant social and economic returns. Investment of THB 211 billion in implementation of the five suggested intervention packages will save 310 000 lives and generate THB 430 billion in benefits for the national economy in the next 15 years. Beyond the principal risk factors for NCDs, the document also discusses other issues that affect health and sustainable development in Thailand, including air pollution. The packages of policies and clinical interventions proposed represent critical initial actions to reverse the NCD epidemic in Thailand. Responsibility for these actions, and the benefits that accrue, go beyond the health sector to have direct and indirect impacts on achievement of all the SDGs, and affect society as a whole.

1 Risk factors such as overweight and obesity, behaviour such as alcohol and tobacco use and physical inactivity and environmental factors such as air pollution.

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Recommendations

The report concludes with recommendations for actionable steps that the Government can take to strengthen a whole-of-government, whole-of-society approach to NCDs and their consequences.

Advocate for additional increases on taxes on health-harming products and for subsidies for healthy products.

Strengthen enforcement of preventive NCD regulations and ensure accountability in all sectors and at all levels.

Implement novel policies to improve access to safe, nutritious food for all.

Address interference from tobacco, alcohol, polluting and food industries to ensure that the public interest supersedes commercial interests.

Strengthen national leadership, coordination and accountability for preventing and controlling NCDs.

Support the work of champions and agents of change.

Develop a robust method for calculating the return on investment of a policy package to reduce air pollution.

1

Introduction

1. Introduction

Noncommunicable diseases (NCDs) are the number one killer in Thailand. Like the rest of the world, Thailand is facing an epidemic of NCDs that has serious public health and economic consequences. NCDs claim the lives of 400 000 people annually or more than 1000 people every day and are responsible for 74% of all deaths in the country. Thai citizens have a 14% risk of dying prematurely (before the age of 70) from one of the four main NCDs (cardiovascular disease (CVD), diabetes, chronic respiratory disease, and cancer), with an 18% probability for men and 11% for women (*1*). Addressing this epidemic would be a significant opportunity to make progress in achieving United Nations Sustainable Development Goal target 3.4, to reduce premature mortality from NCDs by one third by 2030.

The impact of NCDs on human health is clear, but that is only part of the story. NCDs also result in high economic costs, including but reaching far beyond direct health-care costs. NCDs reduce productivity at the macroeconomic level by limiting full participation in the labour force and subsequent effects on individuals, their carers and the state. When individuals die prematurely or are too ill to be in full employment, the labour they would have produced in their remaining working years is lost. In addition, individuals who suffer from a disease are more likely to miss days of work (absenteeism) or to work at reduced capacity while at work ("presenteeism"). NCDs are estimated to have cost over US$ 30 trillion in lost economic output globally between 2011 and 2030, with low- and middle-income countries bearing 70% of the burden (US$ 21 trillion) (*2*). For governments, spending on

The impact of NCDs on human health is clear, but it is only one part of the story. NCDs also result in high economic costs, including, but reaching far beyond, direct health-care costs.

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the treatment of health problems that could otherwise have been prevented represents a significant opportunity cost, including reduced investment in education, transport projects or other forms of human or physical capital that could have had significant returns.

NCDs also threaten the sustainability of Thailand's globally renowned universal health coverage system. In 2017, NCDs already accounted for 48.7% of the budget of the universal coverage scheme (*3*). Thailand is expected to become a super-aged society by 2031, with nearly 30% of the population aged ≥ 60 years (*4*), which will probably increase the prevalence and burden of NCDs. Thus, NCDs will require an ever-larger share of health spending, unless they are prevented and the fiscal space is increased, for example with higher excise taxes on health-harming products.

COVID-19 interacts with NCDs and inequality to form "a perfect storm" of avoidable death and suffering, leading to overburdened health systems, economic contraction and wider setbacks in sustainable development, particularly for people who are already vulnerable. Almost one fourth (22%) of the world's population is estimated to have an underlying condition that increases their risk of a worse COVID-19 outcome; and most of those conditions are NCDs, such as diabetes, cancer, chronic respiratory disease and cardiovascular disease (*5*). Smoking, alcohol consumption, obesity and exposure to air pollution further increase the risk. The COVID-19 pandemic has also increased some NCD risk factors. In Thailand, the physical activity of the population decreased from 74.6% in 2019 (pre-pandemic) to 54.7% in 2020 (*6*). Furthermore, COVID-19 patients with NCDs have faced disruption of, or limited access to, NCD prevention and treatment services. In a WHO survey in 2020, 75% of countries reported considerable disruption of NCD services during the first wave of the pandemic (*7*).

The strong interactions among NCDs and COVID-19 illustrate the importance of addressing NCDs as a core part of the pandemic response. Richard Horton, editor-in-chief of the scientific journal The Lancet, has argued that "COVID-19 is not a pandemic. It is a syndemic …. In the case of COVID-19, attacking NCDs will be a prerequisite for successful containment" (*8*).

Thailand is ranked second from the bottom among the 11 Association of Southeast Asian Nations (ASEAN) countries on the NCD/COVID-19 vulnerability index, which scores countries' vulnerability to COVID-19 according to the prevalence of NCDs and associated behavioural and metabolic risk factors, such as alcohol consumption and hypertension (*9*). Two thirds of the 1403 COVID-related deaths in Bangkok and five perimeter provinces between 1 April and 11 August 2021 occurred among people who also had NCDs, with hypertension (35%), diabetes (25%) and dyslipidaemia (16%) being the first three underlying diseases.[2] Integration of action on NCDs and their risk factors into Thailand's COVID-19 response and recovery plans will give rise to synergies that will accelerate progress in both, strengthen the country's resilience to future health threats and result in early, sustainable socioeconomic revival.

2 Division of Epidemiology and Emergency Operation Team, Department of Disease Control, Ministry of Public Health, Thailand.

The Royal Thai Government is strongly committed not only to early achievement of universal health coverage to strengthen equitable primary health care throughout the country, but also to the NCD response. General Prayut Chan-o-Cha, Prime Minister of Thailand, wrote in The Lancet of his determination "to make NCDs a top development agenda and lead the national multisectoral effort by holding government ministries accountable for developing and enforcing legislation" (*10*). In this positive political and social environment, Thailand has passed progressive legal and policy measures to tackle NCDs. A study published in The Lancet Global Health reported that Thailand had implemented 74% of the recommended NCD policies by 2017, tied for fourth place among 151 countries, in which the mean implementation rate was only 49% (*11*).

Progress is evident in many sectors and areas. Thailand was the first country in Asia and the first middle-income country to introduce plain packaging for tobacco products, in 2019, and the country has continuously increased tobacco and alcohol excise taxes, including adopting a 2% "surcharge" on tobacco and alcohol excise taxes to fund health promotion and NCD prevention (amounting to US$ 132 million in 2017) (*12*). In addition, in 2018, the Ministry of Natural Resources and Environment banned smoking on 24 popular beaches in Thailand. To promote physical activity and environmentally friendly transport, the capital city of Bangkok introduced a bicycle-sharing programme, with 50 stations and 500 bicycles in the central Bangkok area. Furthermore, the Department of Land recently began imposing heavy fines and stopped issuing permits to vehicles that emitted black smoke at levels exceeding the safety limit (*13*). Concerned about the rising prevalence of diabetes and obesity among both adults and children, the Thai Government imposed tiered excise tax rates on sugar-sweetened beverages according to their sugar content (*14*). Currently, the Government is considering a similar tax scheme on salt (*15*), in view of the very high levels of sodium intake by the Thai population, including children (*16*).

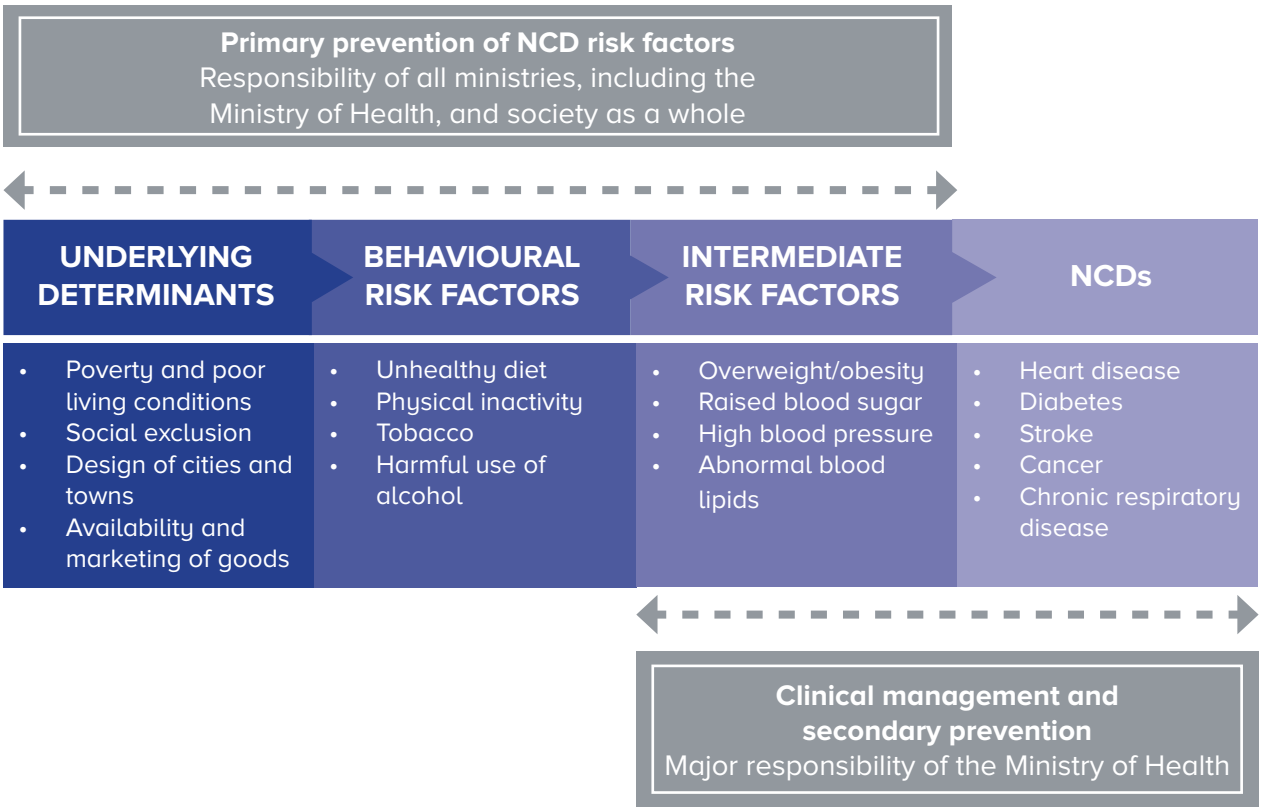
The Government has thus shown a strong commitment to addressing NCDs in the past decade through several national strategies and plans, including the national multi-sectoral NCD strategy, the national sodium reduction strategy, the national tobacco control plan, the national alcohol policy and the national strategy on physical activity. Despite these efforts, Thailand is not on track to achieve the NCD-related SDG goal 3.4, "to reduce premature mortality from NCDs by 30% by 2030".

The United Nations Thematic Working Group on NCD Prevention and Control in 2019 initiated support for the Thai Government in tackling NCDs. The Group comprises 10 United Nations agencies, 5 civil society organizations and 11 Government agencies and provides an important mechanism for capacity development, knowledge exchange and multisectoral responses to scale up action on NCDs in Thailand. The 2021 report of the WHO Director-General to the United Nations Economic and Social Council featured the Thematic Working Group in Thailand, which was also recognized by the United Nations Inter-Agency Task Force on NCDs as an example of a best practice in multisectoral collaboration on NCDs (*17*).

To strengthen advocacy for multisectoral action to reduce NCD risk factors, the Thematic Working Group at its third meeting, on 26 November 2020, called for an NCD investment case for Thailand (*17*). This was endorsed by the NCD Committee of the Country Cooperation Strategy between the Thai Government and the WHO Country Office, Thailand. As a result, a joint virtual mission was undertaken in early 2021 by the United Nations Inter-Agency Task Force on the prevention and control of NCDs, WHO and UNDP to initiate development of an investment case in collaboration with Thai partners (see Methods).

WHO has shown that the risk of NCDs can be reduced by modifying four behavioural risk factors (tobacco use, harmful use of alcohol, unhealthy diet and physical inactivity) and metabolic risk factors such as high blood pressure and high cholesterol (*18*), as at least 80% of premature heart disease, stroke and diabetes and 40% of cancers can be prevented by eliminating these risk factors (*19*). The risk for NCDs can be reduced by eating a healthy diet, undertaking regular physical activity and avoiding tobacco products and alcohol. Deaths and disability from NCDs can also be reduced by reducing people's exposure to environmental risks such as outdoor air pollution. **Fig. 1** illustrates some of the determinants and risk factors that are responsible for NCDs, many of which are beyond the control of the health sector alone.

Fig. 1 Determinants of NCDs and responsibilities for response



WHO has proposed various policy options and cost–effective interventions in its Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020 (*20*) for Member States to use to reduce their NCD burden. These "best buys" were updated at the 2017 World Health Assembly (*21,22*) to include measures to reduce known behavioural and metabolic risk factors for NCDs and clinical interventions to prevent and treat these diseases. An analysis by WHO suggests that every US$ 1 invested in implementing a package of all 16 NCD best buys in low- and lower–middle-income countries will yield a return of at least US$ 7 by 2030 (*23*).

Despite the strong evidence of their cost-effectiveness, the WHO NCD best buys remain under-implemented globally. This is partly because the hidden cost of NCDs (i.e., the economic impact) is often overlooked.

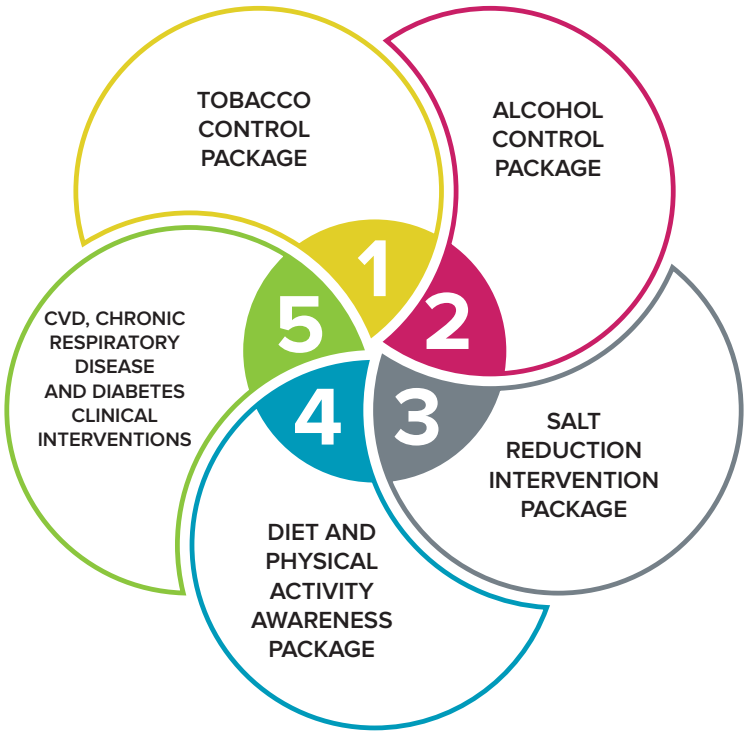
Purpose of the economic analysis in the case for investment

The negative economic impact of NCDs is too often overlooked in budgetary allocation and in weighing the pros and cons of stronger fiscal and regulatory action. Therefore, the quantification of the costs and benefits of interventions to prevent and control NCDs and their resulting 'return on investment' (ROIs) ratios, has been a high-priority request from Member States. Investment cases are designed to help countries make their own economic arguments for action to prevent and control NCDs.

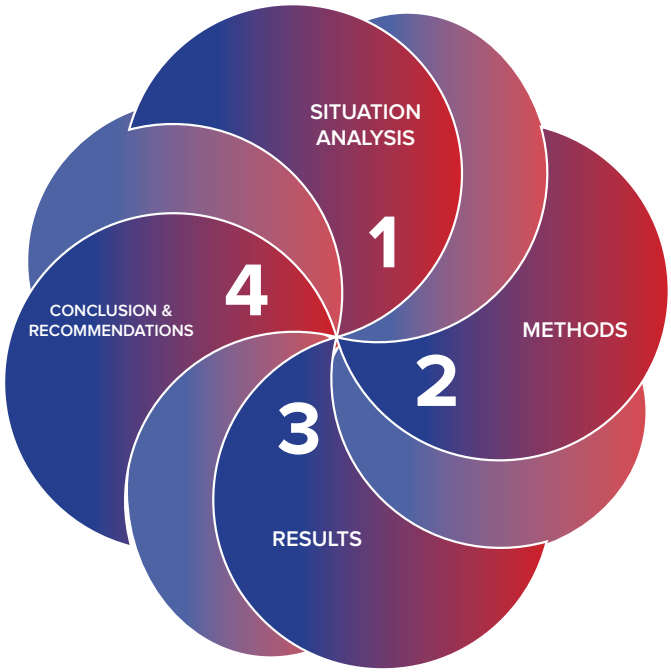
In this analysis, we look at the resources required and the health and economic benefits of investing in one clinical and four policy NCD packages. This is based on quantitative modelling with the OneHealth tool,[3] a dynamic, epidemiology-based population tool developed by United Nations partners for strategic planning and costing of interventions and projection of the health benefits expected from their implementation. For this report, health benefits are estimated in terms of natural units (cases or deaths averted) but are also monetized with the human capital approach for estimating benefit–cost ratios (the primary ROI metric) for each package of interventions. The human capital approach assumes that foregone economic output is equivalent to the total wages that would have been earned by workers during their life, up to retirement age.

3 More information on use of the OneHealth tool is available in the OneHealth tool manual (*24*) and is discussed in detail in Noncommunicable disease prevention and control: A guidance note for investment cases (*25*).

The investment case identifies whether investing in NCD interventions would yield a “positive return” in Thailand. The packages analysed were for:



This investment case report is structured as follows. The situation analysis outlines the health system and institutional arrangements in Thailand and the current level of implementation of evidence-based policies and clinical interventions. The methods section describes the structure of the models used, how they estimates the economic burden of NCDs, the resources required for implementation or scale-up, and how they predict the economic and health benefits of policy implementation. The results section describes the outcomes of application of these models. The conclusions section further discusses the findings, and the recommendations that can be drawn from them, within the context of Thailand.



2

Situation analysis: NCDs and risk factors

NCDs are responsible for 74% of all deaths in Thailand.

2. Situation analysis: NCDs and risk factors

This section summarizes the main NCDs and their behavioural risk factors in Thailand, such as tobacco use, harmful alcohol consumption and high salt intake, and the prevalence of metabolic risk factors such as raised blood pressure, high cholesterol, obesity and diabetes. Premature mortality due to NCDs, measured as the probability of dying from one of the four major NCDs (cancer, cardiovascular diseases, diabetes and chronic respiratory diseases) between the ages 30 and 70 years, decreased from 14.8% in 2010 to 12.7% in 2018. The risk factors that drive Thailand's rapidly rising burden of NCDs are tobacco use, harmful use of alcohol, unhealthy diets, physical inactivity and environmental pollution.

Photo: (left) © Zsuzsanna Schreck; (bottom) Freepik.com

Tobacco kills more than 80 000 Thais annually, responsible for 18% of all deaths.

Photo: © Freepik.com

TOBACCO USE

Over 10 million people in Thailand use tobacco, which kills more than 80 000 Thais annually and is responsible for 18% of all deaths (*26*). According to the WHO Report on the Global Tobacco Epidemic 2021 (*27*), about 17% of adults in Thailand are current daily smokers. The number of tobacco smokers has, however, continued to decrease in recent years, from 24% in 2011 and 21% in 2016 (*28*). An exception, however, is that the prevalence of smoking among female students (13–15 years) increased from 2% in 2008 to 5% in 2015, while the smoking prevalence among male students during the same period remained stable at 15% (*29*). Over 50 000 Thai children aged 10–14 use tobacco daily (*30*).

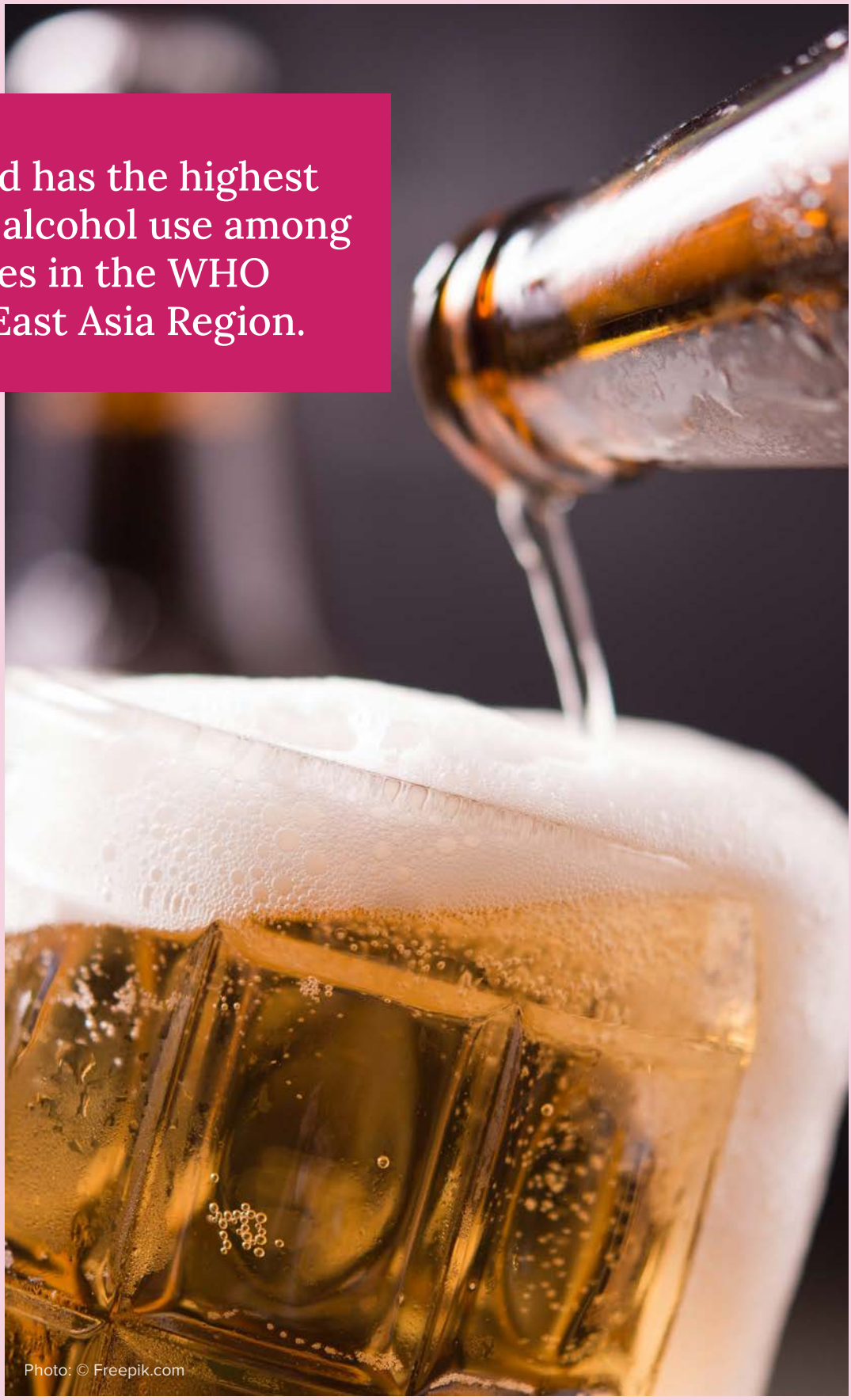
In addition, a large proportion of the population are regularly exposed to second-hand smoke, which kills over 6000 people in Thailand every year (*31*). In 2017, 23.1% of non-smokers were exposed to second-hand smoke at home, with a much higher prevalence among women (26.6%) than men (15.1%) (*32*). A survey by WHO and the Ministry of Public Health in 2015 indicated that one of every three Thai schoolchildren were exposed to second-hand smoke at home in 2015 (*31*).

In the latest Global Youth Tobacco Survey in the country, conducted in 2015 (*26*), about 15% of young people (aged 13–15) reported using some form of tobacco. As among adults, there was a gender difference in tobacco use; however, the difference was considerably lower: 21.8% among males and 8.1% among females. The reported mean age at initiation of daily smoking was low – 17.4 years – indicating that tobacco poses a serious threat to Thailand's youth (*26*).

The 2015 Global Youth Tobacco Survey in Thailand (*33*) also found that 3.3% of students (4.7% of males and 1.9% of females) were current e-cigarette users, despite a ban on e-cigarettes in Thailand. The most recent Global School-based Student Health Survey, in 2021 (*34*), shows that the percentage of e-cigarette users among students has increased to 8.1% (11.1% of males and 5.0% of females). According to the Tobacco Control Research and Knowledge Management Centre, about 30% of high-school students and 60% of university students in Thailand have used e-cigarettes at least once (*35*). A study in 2021 found that over 22% of university students in Thailand regularly smoke e-cigarettes (*36*).

About 37% of current smokers have attempted to quit (*36*). According to the 2015 Global Youth Tobacco Survey (*33*), 72.2% of students who smoked wanted to quit smoking, while only 29.3% had received help in doing so, while systematic support is necessary to encourage and support cessation. Currently, smoking cessation support services include a national toll-free quit line with counselling services by telephone and on social networks, a "SMART" quit programme run by a multidisciplinary team and a package of smoking cessation drugs for workers under the social security health scheme.

Thailand has the highest level of alcohol use among countries in the WHO South-East Asia Region.



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HARMFUL USE OF ALCOHOL

Thailand has the highest level of alcohol use of all the countries in the WHO South-East Asia Region (*37*). In 2016, the total alcohol consumption per capita in Thailand was 8.3 L of pure alcohol, which was much higher than the regional average of 4.5 L (*38*). Alcohol consumption per capita increased from 7.6 L in 2010 to 8.3 L in 2016 and without concerted action, is projected to reach 9.3 L by 2025 (*37*).

Men drink more alcohol than women – 14.3 vs 2.5 L, respectively. Among male drinkers, the total alcohol consumption was 26.2 L per capita in 2016, almost three times the amount for female drinkers (9.2 L per capita) (*37*). The prevalence of heavy episodic drinking[4] was estimated to be 15.7% among people aged ≥ 15 years, at 27.0% for males and 4.9% for females. Among drinkers aged ≥ 15 years, however, 49.4% of males and 17.8% of females reported heavy episodic drinking (*37*). The prevalence of alcohol use disorder was 5.4% in Thailand, higher than the 3.9% average for the Region. It was further estimated that 1.8% of adults (3.5% males and 0.2% females) suffered from alcohol dependence in 2016.

As in the case of tobacco, alcohol use among students in Thailand is a concern. In the 2015 Global School-based Student Health Survey (*39*), nearly one of every four students (23.0%) aged 13–17 years currently drank alcohol and had gotten drunk once or more during their life. The prevalence of alcohol use among female students (13–15 years) more than doubled between 2002 and 2015, from 7% to 16%, while that of boys remained stable at 21% during the same period (*29*).

The number of deaths attributable to alcohol use in the country is estimated to be 22 000 per year, including approximately 6700 deaths in road traffic accidents (*37*). Alcohol was responsible for 71% of deaths due to liver cirrhosis among men and 34% of those due to road traffic accidents (*37*).

Thailand has the highest road death rate (32.7 per 100 000) among the ASEAN countries, and the rate is far higher than the second-highest rate, in Viet Nam, at 22.6 and the ASEAN average of 17.8 (*40,41*). According to the Thai Probation Department, drunk-driving accounted for 95% of 4648 serious traffic offences in Thailand during the New Year period in 2021 (*42*) and for 41.5% of road traffic deaths during the New Year period in 2019 (*43*). Every day in Thailand, road accidents kill 60 people (about 22 000 annually), injure 2500, seriously injure 500 and disable 20 (*41*).

4 Consuming ≥ 60 g of pure alcohol on at least one occasion in the past 30 days.

The most recent data indicate that 30.9% of adults (28.9% of males and 32.7% of females) in Thailand were insufficiently active according to WHO standards.

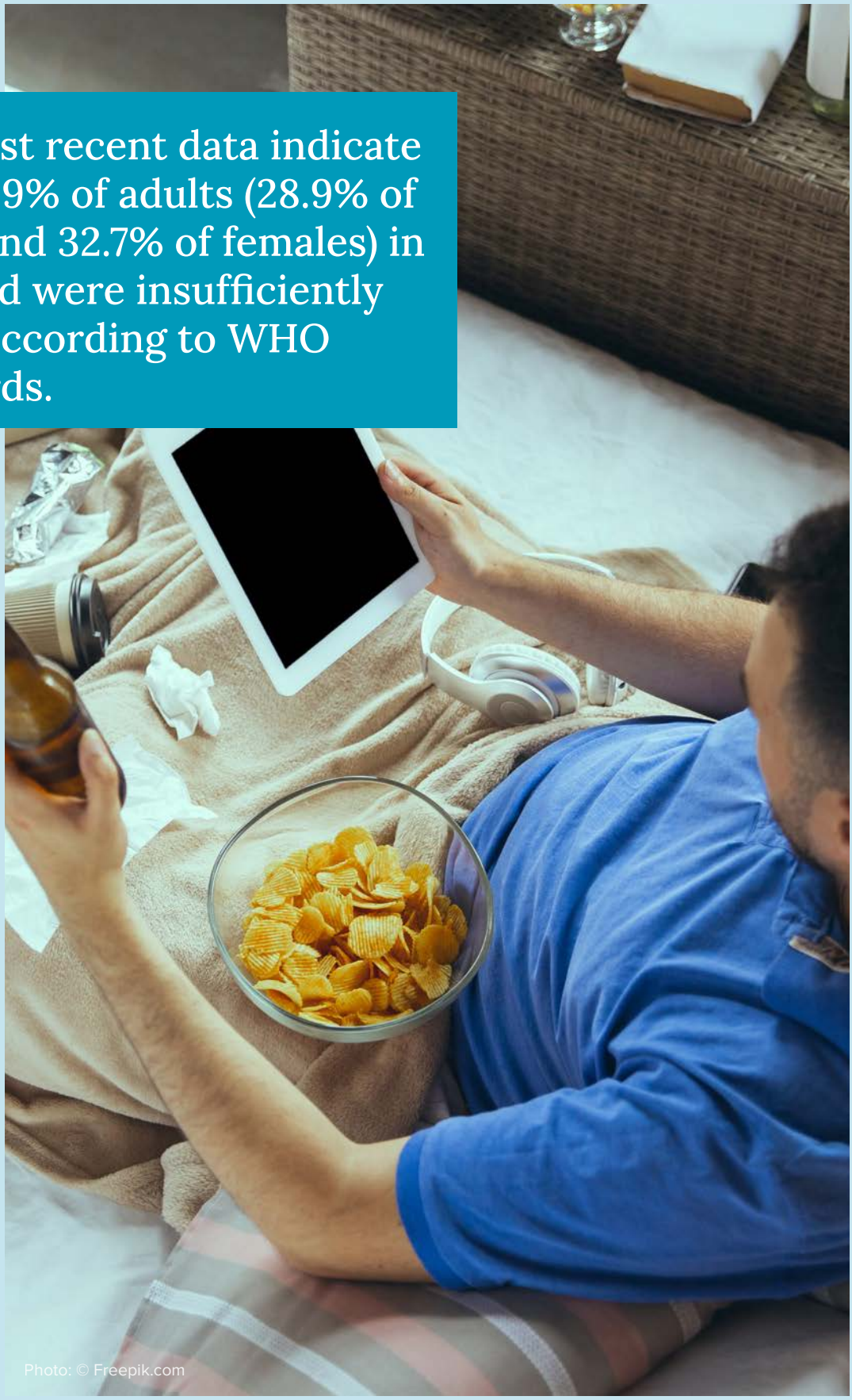

Photo: © Freepik.com

PHYSICAL INACTIVITY

The most recent data indicate that 30.9% of adults (28.9% of males and 32.7% of females) in Thailand were insufficiently active according to WHO standards (150 min of moderate-intensity and 75 min of vigorous-intensity physical activity per week, or equivalent) (*44*), and the trend has increased since 2014 (28.4% in males and 20% in females). One study suggests that a significant reduction in physical activity has occurred as a result of the COVID-19 pandemic in Thailand, from 74.6% in 2019 (pre-pandemic) to 54.7% in 2020 (*7*).

The lack of physical activity is particularly worrying among children. It has been estimated that only 26.2% of Thai children and young people meet the recommended level of physical activity, girls being much less active (16.3%) than boys (34.9%) (*6*).

A recent air pollution crisis in Bangkok also severely restricted opportunities for physical activity, particularly among children. In 2019, for example, all schools in Bangkok were shut for a week, and, in 2020, schools were instructed to suspend all outdoor activities when levels of air pollution intensified (*45*).

UNHEALTHY DIET

WHO recommends that salt consumption not exceed 5 g/day, equivalent to 2 g of sodium per day. The mean population intake of sodium in Thailand was 3.6 g/day in 2020, slightly increased from the baseline of 3.2 g/day in 2009 (*46*).

The average daily consumption of sugar in Thailand is about 20 teaspoons (*47*), which is over four times higher than the WHO's recommended amount of 6 teaspoons (*48*).

Unhealthy dietary behaviour among students in Thailand must be addressed urgently to prevent future NCD cases. For example, in 2015, 56% of students drank carbonated drinks every day (*29*), and the prevalence is increasing. The prevalence of daily consumption of sugar-sweetened beverages by children aged 2–5, 6–9 and 10–14 years increased from 10.5%, 14.5% and 19.1% in 2009 to 12.5%, 20.4% and 19.8% in 2015, respectively (*49*). Only a third of students ate vegetables regularly, and less than half (40%) ate fruit regularly (*39*).

The mean population intake of sodium in Thailand was 3.6 g/day in 2020, nearly twice the amount recommended by WHO.

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METABOLIC RISK FACTORS

A high prevalence of metabolic factors, such as high blood pressure, body mass index or blood lipid levels, significantly increases the risk of a cardiovascular event. While elevated levels of any one factor can increase the risk, it is compounded in individuals with several of these risk factors. WHO risk prediction charts can be used to assess the likelihood that an individual will have a cardiovascular event or die within 10 years by combining six factors: gender, age, blood pressure, cholesterol level, smoking status and whether they have diabetes (*50*). day, which is on the rise. The consumption of sugar sweetened beverage increased from 10.5%, 14.5%, and 19.1% in 2009 to 12.5%, 20.4% and 19.8% among children aged 2-5, 6-9, and 10-14 years, respectively. Only a third of students ate vegetable regularly and only less than half (40%) of students had fruit regularly.

Overweight and obesity

The prevalence of obesity in Thailand is one of the highest in Asia, second only to that of Malaysia and higher than those of high-income countries such as Japan, the Republic of Korea and Singapore (*51*).

According to the National Health Examination Survey in 2021 (*44*), the prevalence of overweight (body mass index ≥ 25 kg/m2) in people aged ≥ 15 years in Thailand was 42.2% (37.8% in males and 46.4% in females), with a significant increase from the level in the survey in 2014, which was 37.5% (32.9% in males and 41.8% in females). The drastic increase in the prevalence of being overweight (more than one standard deviation from the median body mass index by age and sex) among students aged 13–15 years in Thailand is a concern, as it increased from 5% for boys and 4% for girls in 2008 to 23.5% for boys and 16.9% for girls in 2021, a nearly fivefold increase within 13 years (*34*).

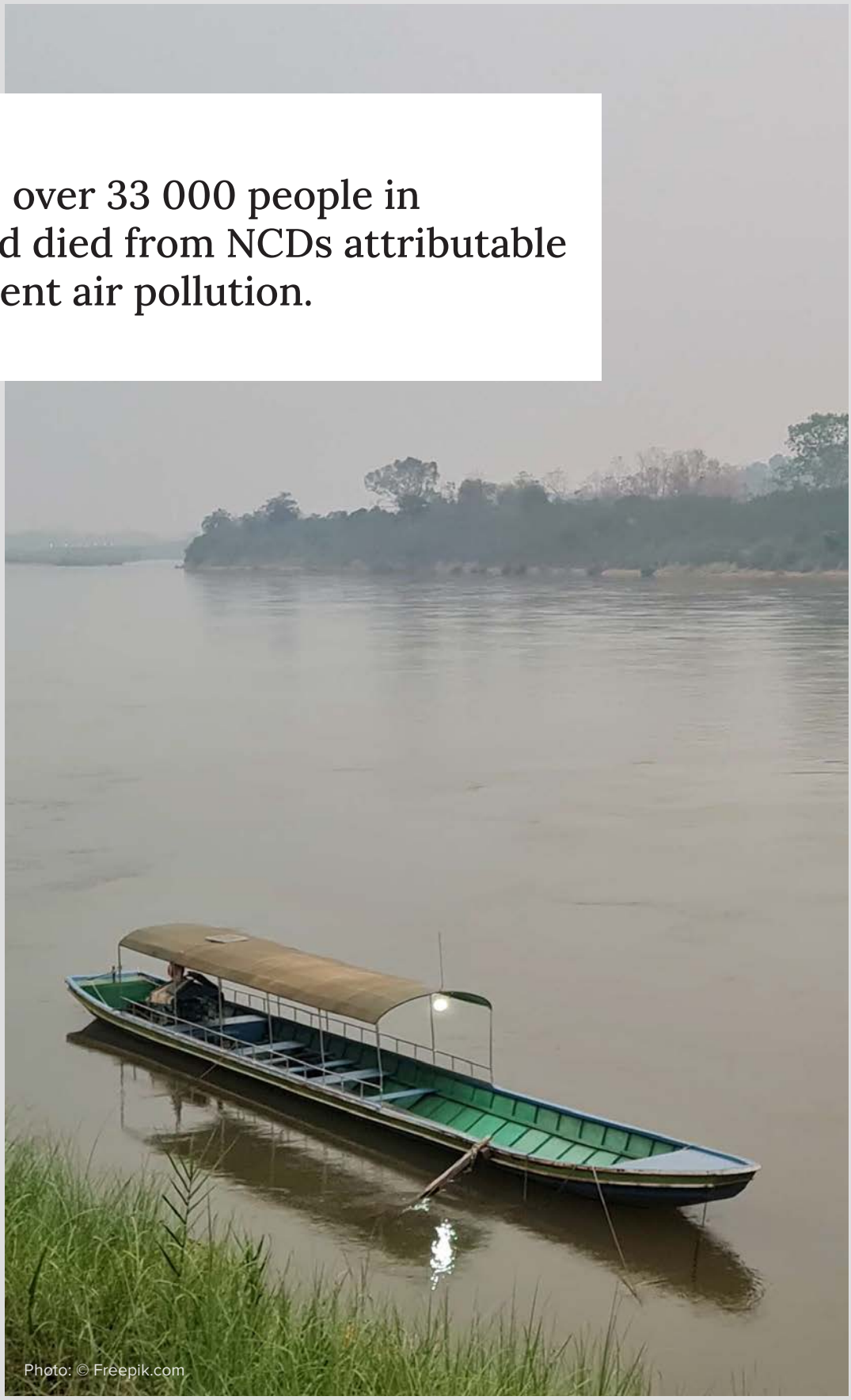
High blood pressure

The prevalence of elevated blood pressure in people aged ≥ 15 years was 25.4% in Thailand in 2021, showing a significant increase from the baseline level of 21.4% in 2009 (*44*).

Raised blood sugar

The prevalence of diabetes in people aged ≥ 15 years was 9.5% in Thailand in 2021, showing a significant increase from the baseline level of 6.9% in 2009 (*44*).

In 2016, over 33 000 people in Thailand died from NCDs attributable to ambient air pollution.



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AIR POLLUTION

In Thailand, particulate matter and ozone are the air pollutants of greatest concern. In 2020, the national annual average concentration of fine particulate matter (PM2.5) was 23 µg/m3, which was about 8% lower than in the previous year (*52*). The reduction has been attributed by the Pollution Control Department to implementation of the national action plan for "Addressing the pollution problem (particulate matter)" and also to reduced economy activity and mobility associated with the COVID-19 pandemic (*52*). While this is within the national ambient air quality standard (25 µg/m3), it is well above the newly released WHO air quality guidelines for annual PM2.5[5] concentration (5 µg/m3) (*53*). Critical areas for ambient air pollution control in Thailand include Bangkok and neighbouring provinces, the northern provinces and Saraburi and Rayong provinces.

According to Thailand Clean Air Network, the groups at higher risk of health impact from air pollution are elderly people, those with underlying conditions, as well as those with lower socio-economic status. The difference depending on socioeconomic status can largely be explained by this group's higher likelihood of living in areas with higher levels of air pollution, as well as lacking the financial means to purchase protective equipment such as N-95 masks and air purifiers. In addition, households with lower socioeconomic status also tend to have less awareness of the harms on health that air pollution cause (*93*).

Although exposure to PM2.5 was reduced in Thailand between 2010 and 2019 (from 34.5 to 27.4 µg/m3), the number of deaths attributable to PM2.5 increased, from 27 800 to 32 200 (*53, 54*) due partly to increase in population size, urbanization, and age structure. The economic cost of outdoor air pollution in Thailand was estimated in 2014 as > US$ 27 billion (*55*).

In 2016, over 33 000 people in Thailand died from NCDs attributable to ambient air pollution (*56*). A study of the burden of disease attributable to ambient air pollution in Thailand estimated that a 20% reduction in ambient air pollution could prevent up to 25% of avoidable deaths each year from all causes and respiratory and cardiovascular diseases (*57*). In addition, an analysis with the Environmental Benefits Mapping and Analysis Program (BenMAP) showed that the PM2.5 concentration in Bangkok contributes to 4 240 non-accidental, 1 317 cardiopulmonary and 370 lung cancer deaths annually (*58*).

5 Atmospheric particulate matter with a diameter < 2.5 mm. As PM2.5 is small and light, it is particularly likely to remain in the air and to penetrate the lungs and circulatory system, resulting in health issues, including NCDs.

Thailand's proactive, continued work on NCDs has nevertheless been effective in many areas. The country has already fully met 12 of the 19 indicators of progress defined by WHO (*59*), although further action is necessary for Thailand to achieve the overall NCD target by 2030, as shown in **Table 1**.

Table 1. Progress in achieving NCD indicators and targets in Thailand

Indicators	Baseline value (year)	Latest value (year)	NCD target by 2030
Probability of dying from CVD, cancer, diabetes or chronic respiratory disease between 30 and 70 years of age (%)	14.8 (2010)	12.7 (2018)	10.3 (25% reduction)
Prevalence of current tobacco use in people aged ≥ 15 years (%)	21.4 (2011)	17.4 (2021)	15.00 (30% reduction)
Prevalence of insufficient physical activity in people aged ≤ 18 (%)	18.5 (2009)	43.7 (2021)	16.7 (10% reduction)
Total alcohol consumption per capita (≥ 15 years of age) (L pure alcohol)	7.13 (2011)	6.86 (2019)	6.0 (10% reduction)
Mean population intake of sodium (mg/day)	3,246 (2009)	3636 (2020)	2285 (30% reduction)
Prevalence of raised blood pressure (%)	21.4 (2009)	25.4 (2021)	16.1 (25% reduction)
Prevalence of diabetes in people aged ≥ 18 years (%)	6.9 (2009)	9.5 (2021)	6.9 (0% increase)
Prevalence of overweight (body mass index ≥ 25 kg/m2) in people aged ≥ 18 years (%)	34.7 (2009)	42.2 (2021)	34.7 (0% increase)
Facilities with essential medicines and technologies to treat major NCDs (%)	More than 80%	More than 80%	80%
At least 50% eligible people receive drug therapy and counselling (including glycaemic control) to prevent heart attacks and strokes	More than 50%	More than 50%	50%
Annual mean concentrations of fine particulate matter (PM2.5) in urban areas ($\mu g/m^3$)	-	31.9 (2016)	-

Photo: © Zsuzsanna Schreck

3

Policies and treatments to reduce the NCD burden

3. Policies and services to reduce the NCD burden

3.1 NCD financing

In 2001, the Thai Government launched a universal tax-financed social health protection scheme – the Universal Health Care Coverage Scheme. With other national social health insurance schemes, such as the Social Security Scheme for private sector workers and the Civil Servant Medical Benefit Scheme, the universal coverage scheme ensures nearly 100% population coverage for essential health services (*61*). Total health expenditure was approximately US$ 362 per capita in 2018 (US$ 723 in international US$). General domestic Government health expenditure accounts for 76% of total health expenditure and constitutes about 15% of total Government spending. Out-of-pocket spending on health is estimated to be 11% of total health expenditure, which is significantly lower than the average for East Asia and Pacific countries (estimated at 26.2%) (*62*). Thus, most NCD costs are publicly funded, accounting for 49% of the universal coverage scheme budget in 2017.

Currently, the largest proportion of NCD-related spending under the scheme is for inpatient services (*63*). A WHO review of the Thai health system in 2015 indicated a high rate of avoidable hospital admissions of patients with NCDs due to limited integration of preventive NCD services into primary health care (*64*). Only 1.73% of the scheme's NCD budget is allocated to health promotion. This low rate is partly mitigated by the work of the Thai Health Promotion Foundation (ThaiHealth), which has been funded by a 2% surcharge on alcohol and tobacco excise taxes since 2001 and plays a central role in health promotion.

The resources required for NCD treatment are projected to increase in the coming years, particularly because Thailand's population is ageing. Today, people aged ≥ 60 constitute about 17% of the Thai population, and the number is expected to grow by about 5% per year (*65*). The World Bank projected that, by 2040, over 25% of the population will be > 65 (*66*), increasing pressure on national social security schemes as a result of growing expenditure on benefits and a simultaneous reduction in the funding base, i.e., the proportion of the working population that finances social security systems through taxes or mandatory insurance contributions. To support healthy ageing and better preserve people's productive potential, the NCD response in Thailand must be enhanced, specifically by reducing the main risk factors and further improving access to prevention and treatment services.

3.2 Policy and institutional arrangements

A 5-year (2017–2021) national plan for the prevention and control of NCDs was adopted in 2017 to guide and promote a range of policy measures and initiatives to address NCDs (*66*). The main goal of the plan is to reduce the avoidable burden of illness, death, and disability results from NCDs by means of cooperation among various alliance networks and national, regional and global collaboration to ensure that the population is in good health, to optimize the productivity of all age groups and to ensure that NCDs do not reduce the quality of life and economic development by 2021. The plan contains nine targets:

specific targets of the Five-Year National NCDs Prevention and Control Plan

1. Premature mortality

Decrease the rate of premature mortality from NCDs by 20% as compared with 2010

2. Alcohol use

Decrease harmful alcohol use be people < 15 years to < 6.7 L/person per year

3. Physical inactivity

Decrease the prevalence of physical inactivity by 8% as compared with 2010

4. Salt consumption

Decrease average salt (sodium) intake by 24% as compared with 2010

5. Tobacco use in youth

Decrease the prevalence of tobacco use be people < 15 years to < 15.7%

6. Blood pressure

Decrease the prevalence of raised blood pressure by 20%

7. Diabetes and obesity

Stabilize the prevalence of diabetes and of obesity to the levels in 2010

8. CVD and heart disease

Ensure that ≥ 50% of the population > 40 years with conditions indicative of heart disease and cerebrovascular disease have a consultation for behavioural changes and preventive drug therapy (including for glycaemic control)

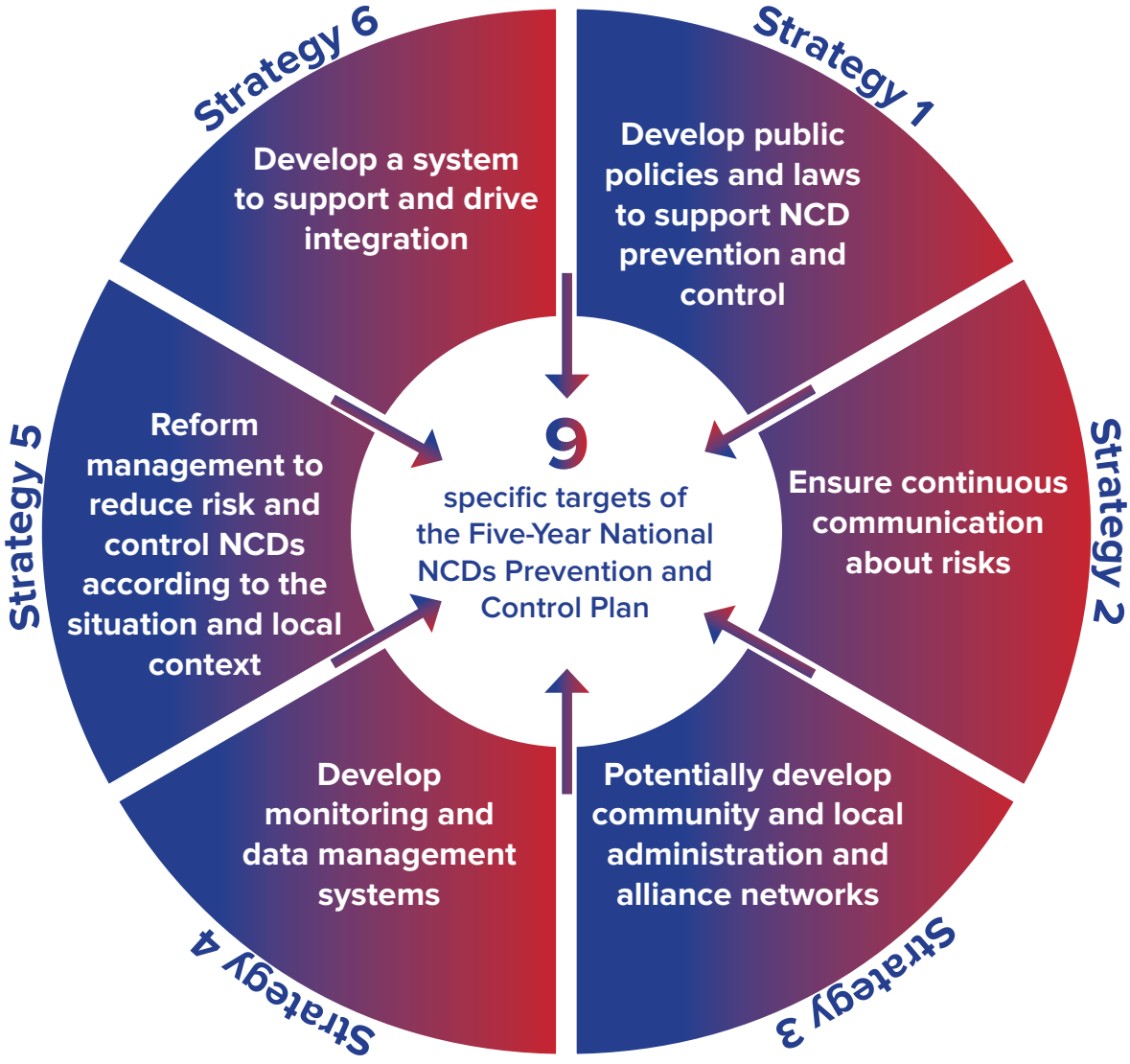
9. NCDs treatment

Ensure that the necessary drugs and essential technology for treatment and management of key NCDs are available at 80% of all public and private medical facilities

The plan further identified six strategies for achieving these targets:

6

priority strategies to achieve the targets



The plan is aligned with the Twenty-year National Strategy (2018–2037) (*67*), which includes long-term objectives that require strengthening the NCD response. Thus, three of the six long-term objectives of the strategy cannot be achieved without better NCD prevention and control. These are:

- the well-being of Thai people and society;
- national competitiveness, economic growth and income distribution; and
- development of human capital.

In addition to the five-year plan for the prevention and control of NCDs, the Government launched the National Plan to Promote Physical Activity (2018–2030), manifesting its commitment to promoting a healthy lifestyle among Thais. An inactive lifestyle is considered one of the key drivers of NCDs in young population groups and is therefore prioritized by the Government.

The NCD response in Thailand is led primarily by the Ministry of Public Health, which is responsible for formulating and implementing health policy, including for NCDs. It is the key implementor of the 5-year NCD plan and coordinates the work of other public and civil society institutions. Several specialized bodies within the Ministry have been established for targeted NCD action, including the Thai Healthy Lifestyle Strategic Management Office, the Bureau of Noncommunicable Diseases and the Bureau of Tobacco Control.

Other Government ministries also contribute to implementation of national NCD policies. The ministries of Finance, Commerce, Education, the Interior and Industry were all assigned roles and responsibilities under the 5-year NCD plan.

3.3 Current state of implementation of NCD prevention and control measures

3.3.1 Tobacco

Thailand has made remarkable achievements in tobacco control over the past few decades, notably since the country ratified the WHO Framework Convention on Tobacco Control in February 2005 and implemented a comprehensive tobacco control policy (*68, 69*). For example, Thailand has the highest tobacco tax rate (78.6% of retail value) in the WHO South-East Asia Region, according to WHO's 2021 Report on the global tobacco epidemic (*70*). Thailand was the first country in Asia and the first middle-income country to introduce plain cigarette packaging, in which the logo-free brand name appears in standardized format next to a graphic warning to make smoking less attractive. Thailand has banned electronic cigarettes as well as smoking and cigarette-butt litter on its most popular beaches, which protects not only the health of tourists and local residents but also the country's vital economic resources: beautiful beaches, pristine oceans and diverse marine life. Furthermore, the minimum age of access to tobacco products was raised from 18 to 20 in 2017.

More remains to be done, however, particularly in enforcement of policies and laws limiting access of young people to tobacco products and in tobacco taxation. According to Dr Ronnachai Kongsakon, director of the Tobacco Control Research and Knowledge Management Centre at Mahidol University, 85% of shops do not check the age of purchasers when they sell cigarettes, and two thirds have sold cigarettes to people under the legal age (*71*).

Thailand received a score of only 1.75 out of 5 on the most recent Tobacco Tax Scorecard, which assesses the performance of tobacco tax policies in 174 countries (*72*). Despite the high tax rate, cigarettes are no less affordable today than in 2010 (*70*) because of income growth and inflation. Thailand has different tax rates for different tobacco products, with the excise tax rate on shredded tobacco and roll-your-own tobacco products being nearly one tenth of the than the those on manufactured cigarettes (*73, 74*). Tiered rates are harmful, particularly for lower-income and young groups, as they deprive them of an opportunity to stop or reduce tobacco use by incentivizing them to switch to lower-priced tobacco products.

With regard to tobacco industry interference and tobacco growing, Thailand was ranked 10th out of 80 surveyed countries according to the Global Tobacco Industry Interference Index 2020, with an overall score of 43, as the tobacco industry is not prohibited from promoting itself through "socially responsible" activities (*75*). In addition, the economic return on tobacco farming has been used as an argument against increasing the tobacco tax in Thailand (*76*), although, as in most countries, tobacco farming and manufacture represent a decreasing share of economic activity. Therefore, the Government should find ways to help tobacco farmers shift to alternate, sustainable crops or should use the revenue from taxes to improve their livelihoods.

Table 2 summarizes Thailand's current tobacco control measures and compares them with measures proposed in the MPOWER intervention package, as reported in the 2019 WHO report on the global tobacco epidemic (*68*).

Table 2. Current tobacco control measures in Thailand

Measures in MPOWER package	Current state of implementation
Monitor tobacco use and prevention policies.	Thailand became a Party to the WHO Framework Convention on Tobacco Control on 27 February 2005. The Tobacco Products Control Act 2017 (BE 2560) entered into force on 4 July 2017 as the primary legislation governing tobacco control in Thailand. The National Committee for Tobacco Control is the responsible body. The prevalence of smoking in the Thai population aged ≥ 15 years is monitored within the Health Behaviour of Population Survey conducted by the National Statistics Office, and the National Health Examination Survey, conducted every 5 years among the population aged ≥ 15 years. Tobacco use by students is monitored in the Global Youth Tobacco Survey and the Global School-based Student Health Survey, both of which are conducted by the Ministry of Public Health with partner agencies such as the Ministry of Education and WHO.

Measures in MPOWER package	Current state of implementation
Protect people from tobacco smoke.	Smoking is prohibited in all indoor public places, indoor workplaces and public transport and in the following outdoor places: facilities for exercise, sports training, sports playing and sports competitions of all kinds, public parks, zoological parks, amusement parks, children's playgrounds and markets. The regulations are part of the Ministry of Public Health Notification Re: Identification of Types or Names of Public Places, Workplaces and Vehicles, Entirely or in Part, as Non-Smoking Areas or Smoking Areas in Non-Smoking Areas (BE 2561).
Offer to help to quit tobacco use.	The Thai Health Promotion Foundation, funded by a 2% surcharge on tobacco and alcohol excise taxes, supports the National Quitline for smoking cessation free of charge (*77*). In addition, the Government supports a "SMART Quit Clinic Programme" by a multidisciplinary team, and a benefits package of smoking cessation drugs is available to workers under the Social Security Health Scheme. Support for tobacco cessation is provided in primary health care by a network of one million community health volunteers and "health-promoting hospitals".
Warn people about the dangers of tobacco.	Plain packaging has been required for all cigarettes available for retail sale since 8 December 2019 according to the Ministry of Public Health Notification of Criteria, Methods and Conditions of Tobacco Product and Cigarette Packaging (BE 2561). The law requires pictorial health warnings on cigarette package that occupy 85% of the top of the front and back principal display areas. Pictorial health warnings are also required on shredded tobacco (typically used for hand-rolled cigarettes and smokeless tobacco products) and cigars. Misleading packaging and labelling, including terms such as "light" and "low tar", is prohibited.
Enforce bans on tobacco advertising, promotion and sponsorship.	A ban on tobacco advertising was first implemented in 1989. The latest updates to legislation on tobacco advertising, promotion and sponsorship were implemented under the Tobacco Products Control Act 2017. Article 35 of the Act stipulates that business operators and related people shall not be allowed to sponsor or support individuals, groups or public or private agencies associated with the tobacco industry, including promoting images of tobacco products, manufacturers and importers of tobacco products, advertising of tobacco products, their manufacturers or importers and promoting tobacco consumption, in any way that interferes with tobacco control policies. An exemption is still made for donations and humanitarian assistance in severe disasters, although this kind of activity and news about such activity cannot be promoted to the public.
Raise taxes on tobacco.	Tobacco taxation in Thailand is a mixed system. Excise tax rates are 20% of the ad valorem suggested retail price for products costing ≤ THB 60/pack and THB 1.2/stick, 40% of the ad valorem suggested retail price for products costing ≤ THB 60/pack and THB 1.2/stick and 40% of the ad valorem rate for products costing ≤ THB 60/pack and THB 1.2/stick. Value added tax is 7% of the retail price. A total of 17.5% of the calculated excise tax is earmarked for local government (10%), the Thai Health Promotion Foundation (2%), the Thai public broadcasting service (1.5%), the sporting fund (2%) and the elderly fund (2%).

Most of these policy interventions are also WHO "best buys" (*21*), which are effective interventions that are also cost-effective. The list of "best buys" largely corresponds to those found in the OneHealth tool (*24*) and those modelled for the ROI analysis:

- Monitor tobacco use and prevention policies.
- Protect people from tobacco smoke.
- Offer to help quit tobacco use: mCessation.

- Warn about danger: warning labels
- Warn about danger: mass media campaigns
- Enforce bans on tobacco advertising.
- Enforce restriction of access by young people.
- Raise taxes on tobacco.
- Use plain packaging for tobacco products.

3.3.2 Alcohol

The updated Appendix 3 of WHO's Global action plan for the prevention and control of NCDs 2013–2020 (*20*) lists core policy options for alcohol control. These are reproduced in **Table 3**, with some of the achievements made in reducing alcohol consumption in Thailand.

Table 3. Current state of alcohol control interventions in Thailand

Policy	Policy options	Current state of implementation
Taxation	**Increase excise taxes on alcoholic beverages**	Since passage of the Excise Tax Act 2017 (BE 2560), Thailand has had a combined taxation system of specific and ad valorem rates. The ceiling of the ad valorem tax rate, based on suggested retail prices, is 30% for any type of alcoholic beverage. Ceilings for specific tax include THB 300/L of ethanol for fermented alcoholic beverages and THB 1000/L of ethanol for distilled alcoholic beverages. The actual tax rates for most alcoholic beverages are far lower than the ceilings. The actual rates differ for 12 subtypes of alcoholic beverages indicated in the Act. The actual ad valorem rates range from 0% to 22% for fermented alcoholic beverages (0% for wine made from grapes or other fruit with suggested retail prices < THB 1000 and 22% for beer). The actual ad valorem tax rate is 2% for domestic rice spirit (เหล้าขาว), whereas the rate is 20% for other distilled alcoholic beverages. The actual specific tax rates range from THB 150 to 1500/L of ethanol for fermented alcoholic beverages (the lowest rate for ready-to-drink alcoholic beverages with a quantity of ≤ 330 mL/container and the highest rate for any types of wine made from grapes). The actual specific tax rate is THB 155/L of ethanol for domestic rice spirit (เหล้าขาว), whereas the rate is THB 255/L of ethanol for other types of distilled alcoholic beverages. These tax rates purportedly favour domestic products. All tax rates remain unchanged since the Excise Tax Act entered into force in 2017. Value added tax is at 7% of retail price. Custom import duty is 60% but 0% for alcoholic beverages imported from the ASEAN Free Trade Area since 2003. A total of 17.5% of calculated excise tax is earmarked, with 10% for local government, 2% for the Thai Health Promotion Foundation, 1.5% for the Thai public broadcasting service, 2% for the sporting fund and 2% for the elderly fund.

Policy	Policy options	Current state of implementation
Advertising	**Enact and enforce bans or comprehensive restrictions on exposure to alcohol advertising (in multiple types of media)**	Alcohol advertising, which is defined as "marketing communication" in the Alcohol Control Act 2008 (BE 2551), is banned except for some specific content (information or social creative knowledge without any illustration of the alcoholic beverage or its package) and that broadcast from outside Thailand. Alcohol advertisements can be broadcast on television and radio between 22.00 and 05.00.
Availability	**Enact and enforce restrictions on the physical availability of retailed alcohol (reduced hours of sale)**	According to the Excise Tax Act 2017, there are two types of alcohol license: type 1 for selling > 10 L/purchase of all alcoholic beverages and type 2 for selling < 10 L/purchase. Under the Alcohol Control Act 2008, alcohol may be sold between 11.00 and 14.00 and 17.00 and 24.00. It is prohibited in the following places: temples and other religious places; hospitals, clinics, pharmacies and other health-care facilities; premises and areas of Government and State enterprises; factories; educational institutes and nearby areas; dormitories; petrol stations; public parks (Government and State enterprises); national parks; train stations and on trains; bus terminals; ports and public ferries and boats; and on public roads.
Drink-driving	**Enact and enforce drink-driving laws and blood alcohol concentration limits at sobriety check-points**	According to the Road Traffic Act 1979 (BE 2522), improved in 2007 (BE 2550), the legal blood alcohol concentration limit is 0.05 g/dL for general drivers and 0.02 g/dL for drivers aged ≤ 20 years, drivers who hold a temporary driving license, drivers who are driving with the wrong type of license and drivers who have no driving license or whose license has been suspended or revoked. Random breath tests for drink-driving have been partially implemented. The police are authorized to stop and test any driver at any time; however, there is no operating procedure for ensuring the effectiveness of the measure to systematically deter drinking and driving.
Brief interventions	**Provide brief psychosocial interventions for people with hazardous and harmful alcohol use**	Screening for risky drinking and alcohol use disorders has been adopted by the Ministry of Public Health and implemented since 2018. Public hospitals in Thailand are obliged to use the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) to screen people aged ≥ 15 years once a year when they seek services at any public health facility. A brief intervention is to be provided to people at moderate-to-high risk, which includes referral to appropriate specialist treatment for people at high risk. In 2020, about 12.6 million people were screened for alcohol-related risk (about 34% of Thai adults aged ≥ 15). Approximately 11% of those screened were at moderate or high risk, and 65% received a brief intervention or were referred to specialist treatment.

In **Table 3**, the first three policy interventions listed are also WHO "best buys", and the fourth and fifth are WHO "effective interventions". These largely correspond to those that were modelled for the ROI analysis:

- Enforce restrictions on the availability of retailed alcohol.
- Enforce restrictions on alcohol advertising.
- Enforce drink–driving laws (sobriety check-points).
- Raise taxes on alcoholic beverages.
- Provide screening and brief interventions for hazardous and harmful alcohol use.

3.3.3 Physical inactivity

The updated Appendix 3 of WHO's Global Action Plan for the Prevention and Control of NCDs 2013–2020 (*19*) lists several policy options for increasing physical activity. These are reproduced in **Table 4**, with some achievements in increasing physical activity in Thailand.

Table 4. Current state of physical activity interventions in Thailand

Policy	Policy options	Current state of implementation
Knowledge	**Public awareness and motivational communications for physical activity, including mass-media campaigns for physical activity**	National mass media campaigns targeting various population groups have been organized by the Division of Physical Activity and Health and the Thai Health Promotion Foundation since 2005. 2005–2010: "Exercise = best medicine" and "Moving = exercise" campaigns were introduced to increase understanding of the benefit of physical activity and exercise. 2011–2019: "Fatless belly Thais" campaigns were organized targeting the working-age population, integrating healthy diets and physical activity to reduce obesity. 2012–2018: "Run for new life" campaigns were conducted to inspire Thais to practise a healthy lifestyle. 2020–2021: "National step challenge" campaigns extended physical activity to local communities.
Health system	**Provision of brief physical activity counselling and referral in routine primary health care**	The Department of Health NCD Bureau and the Department of Disease Control established NCD Clinic Quality Plus, and the Department of Health provided physical activity counselling in the Diet and Physical Activity Clinic. The initiatives are linked to regional, provincial, district and sub-district hospital and primary health-care services. Patients receive advice on participating in physical activity voluntarily.

Policy	Policy options	Current state of implementation
Environment Drink–driving	**Ensure that macro-level urban design incorporates the core elements of residential density, connected street networks with sidewalks, easy access to various destinations and access to public transport**	The Department of Public Works and Town and Country Planning under the Ministry of the Interior builds enabling environments for active citizens. The Town Planning Act 2019 (BE 2562) specifies that national, regional, provincial and city master plans must ensure essential basic infrastructure, including public transport. Local master plans should be based on the "transit-oriented development" concept and include safe sidewalks to prioritize walking. Major provinces in Thailand, such as Bangkok, Phuket and Khon Kaen, have implemented the Act with city planning guidelines that prioritize connectivity to public transport.
	Provision of convenient, safe access to high-quality public open spaces and adequate infrastructure for walking and cycling	Development of public open spaces and public parks was not specified in the latest Planning Act 2019 (BE 2562); however, the Department of Public Works and Town and Country Planning, which is committed to achieving SDG 11.7, promotes development of safe, accessible public open spaces. There are currently more than 500 public parks and green open spaces in the country. It is not yet known whether they are effective in promoting physical activity and a healthy lifestyle.
Setting	**A whole-of-school programme that includes high-quality physical education and adequate facilities and programmes to ensure physical activity of all children**	Physical education is mandatory in Thailand. Thus, all schools are required to deliver physical education in class for 1 h/week. Exercise, physical activity and recreation are key components of the Health-promoting Schools initiative. More than 90% of Thai schools participate in the initiative.
	Multicomponent workplace physical activity programmes	On 22 November 2016, the Prime Minister ordered all Government offices to organize physical activity sessions every Wednesday afternoon. The impact of the initiative is unknown. Initiatives to promote physical activity in the workplace include Happy 8 (physical activity as part of Happy Body) and Fatless belly Thai.
Promotion	**Promotion of physical activity through organized sports groups, clubs, programmes and events**	The sixth National Sports Development Plan (BE 2560–2564) highlighted two of six strategies: raise awareness about exercise and sports and promote mass participation in sports for all. Running events were organized in the 5 years before COVID-19. In 2019, over 1800 running events were organized, estimated to have involved four or five million runners across the country. Over one million people participated in a National Steps Challenge, organized by the Department of Health. The aim of the programme is to promote walking and running.

The OneHealth tool, used as part of the ROI analysis, modelled policy changes in campaigning on physical activity to raise public awareness, as well as providing brief advice on the benefits of physical activity as part of routine care.

3.3.4 Unhealthy diets

Table 5 shows Thailand's current state of implementation of WHO's salt reduction policy package (SHAKE), which outlines measures that countries can take to reduce salt intake (*78*).

Table 5. Current state of policies to reduce salt consumption in Thailand

Policy	Description[a]	Current state of implementation
Surveillance: measure and monitor salt use.	**Measure and monitor population salt consumption patterns and the sodium content of food.**	The latest survey of salt or sodium intake was conducted by the Low Salt Network in 2019–2020 from 24-h urine samples. A routine survey for monitoring sodium intake has not yet been established.
Harness industry: promote reformulation of foods and meals to contain less salt.	**Set targets for the amount of salt in foods and meals, and implement strategies to promote reformulation.**	A draft policy on the maximum sodium limit in packaged foods is being developed, with wide support by public health agencies, including the Health Reform Committee. The draft will be considered by the Thai Food and Drug Administration.
Adopt standards for labelling and marketing: implement standards for effective, accurate labelling and marketing of food.	**Adopt front-of-pack nutrition labelling systems (e.g., colour-coded for salt content, "high salt" warning)**	Thailand has adopted "guideline daily amount" labels according to Ministry of Public Health Notification No. 394 issued in compliance with the Food Act BE 2522.
Knowledge: educate and communicate to empower individuals to eat less salt.	**Implement integrated education and communication strategies to raise awareness about the health risks and dietary sources of salt in order to change behaviour.**	National campaigns to raise public awareness about salt consumption and health risks have been organized in various media by the Low Salt network, supported by the Thai Health Promotion Foundation, the Department of Disease Control, the Thai Food and Drug Administration and partners.
Environment: support settings to promote healthy eating.	**Implement multicomponent salt-reduction strategies in community settings (e.g., schools, workplaces, hospitals).**	In accordance with the Thai SALTS strategy (2016–2025), a low-salt diet policy has been implemented in pilot public hospitals and local communities.

a From the SHAKE technical package for salt reduction

Four of these interventions (reformulation, environment, knowledge, labelling) are WHO "best buys", and six correspond to those in the OneHealth tool that were modelled for the ROI analysis:

- surveillance
- harness industry for reformulation
- adopt standards: front-of-pack labelling
- adopt standards: strategies to combat misleading marketing
- knowledge: education and communication
- environment: salt-reduction strategies in community eating spaces.

The updated Appendix 3 to WHO's Global action plan for the prevention and control of NCDs 2013–2020 (*20*) contains two "effective interventions", on trans-fats and sugars, respectively. The current state of their implementation is shown in **Table 6.**

"We in Thailand are convinced that a healthy population is central to the country's development. We remember what Thailand's father of modern medicine and public health, Prince Mahidol, taught us: to put the interests of people before self and commercial interests when it comes to the development and implementation of public policies." (10)

Table 6. Current status of implementation of policies for trans-fats, saturated fats and sugars in Thailand

Policy	Description[a]	Current state of implementation
trans-Fats	**Reduce industrial trans-fat intake to < 1% of total energy intake through legislation to ban the use of trans-fats in the food chain.**	With Ministry of Public Health Notification No. 388, which came into force on 9 January 2019, Thailand has banned the use of artificial trans-fats in domestic and imported food. The Notification also bans partially hydrogenated oils and food products containing them.
Saturated fats	**Reduce intake of saturated fats to < 10% of total energy intake, for example by: (i) reducing incentives for the food industry to continue or increase production of processed foods containing high levels of saturated fats; (ii) establishing standards for healthy dietary practices in pre-schools, schools, other public institutions and the workplace; and (iii) exploring regulatory and voluntary instruments (e.g., marketing regulations and nutrition labelling policies) and economic incentives or disincentives (e.g., taxation or subsidies) to promote healthy diets.**	The Department of Health is developing nutrient profiling for use as a standard tool for classifying levels of nutrients (including total calories, total fat, saturated fats, sugar, sodium, fibre and vitamins) in each food product.
Sugar	**Reduce intake of free sugars to < 10% of total energy intake through effective taxation on sugar-sweetened beverages. A reduction to < 5% of total energy intake would provide additional health benefits.**	According to the Excise Tax Act 2017 of September 2017, sugar-sweetened beverages are taxed in a tiered system, with both ad valorem and specific rates. The ad valorem portion is calculated from the suggested retail price, while the specific tax depends on the sugar content, as follows: a high tax for a sugar content > 14 g/100 mL, a moderate tax for a sugar content of 8–14 g/100 mL and a low tax for a sugar content of 6–8 g/100 mL prompts; a sugar content < 6 g/100 mL is not taxed. This tax rate will increase every 2 years until 2023.

a Information derived from WHO key facts for a healthy diet (*79*)

As the OneHealth Tool cannot yet calculate the impact of interventions on fats and sugar, these are not included in the ROI analysis.

3.3.5 CVD and diabetes : Clinical interventions

The updated Appendix 3 to WHO's global action plan for the prevention and control of NCDs 2013–2020 (*18*) lists a number of clinical interventions for CVD and diabetes. A selection of those most relevant to this analysis is listed in **Table 7**, with an assessment of their situation in Thailand.

Table 7. Current status of clinical policies to reduce risks for CVD and diabetes in Thailand

Policy	Description	Current state of implementation
CVD risk assessment and management	Screening for risk of CVD and diabetes	The entire eligible population (> 35 years) is screened annually in the community for hypertension. Additionally, all adults who visit any health facilities have their blood pressure measured and are assessed for CVD risk. All patients with blood pressure BP≥ 140/90 or a CVD risk score > 20 receive treatment and follow-up as per Thai hypertension guidelines. Provision of drug therapy and counselling at health facilities and the cost are covered by national health security schemes.
	Provision of drug therapy (including glycaemic control for diabetes mellitus and control of hypertension in a total risk approach) and counselling for individuals who have had a heart attack or stroke and those at high risk (≥ 30%) of a fatal or nonfatal CVD event in the next 10 years	
Acute myocardial infarction and stroke	Treatment of new cases of acute myocardial infarction with either acetylsalicylic acid (aspirin) or aspirin and clopidogrel or thrombolysis or primary percutaneous coronary interventions	Any hospitalization for a CVD event has been reimbursed through fee schedules additional to payment based on diagnosis-related groups since 2009. The majority of the Thai population lives in the provinces, where district hospitals provide primary and secondary services. Certain district hospitals can perform reperfusion for thrombolysis but not percutaneous coronary interventions. A care map for "ST-segment elevated myocardial infarct" (STEMI) and fast-track arrangements have been developed by the National Health Security Office and the Ministry of Public Health and is advocated by the Heart Association of Thailand to ensure effective health care and lower mortality rates (80).
	Treatment of acute ischaemic stroke with intravenous thrombolytic therapy	
	Treatment of cases with established ischaemic heart disease and post-myocardial infarction	
Diabetes	Glycaemic control	All eligible people (> 35 years) are screened annually for diabetes in primary care. All patients with diabetes receive treatment under the Government insurance schemes.
	Diabetic retinopathy screening and foot care to avoid complications	Patients with diabetes are screened annually for diabetic retinopathy, kidney disease and foot lesions at health facilities to monitor complications. The service fees are covered by the Government health schemes.

The following package of interventions was modelled with the OneHealth tool for the ROI analysis:

- screening for risks of CVD and diabetes
- treatment for patients with very high cholesterol but low absolute risk of CVD and diabetes
- treatment for those with high blood pressure but low absolute risk for CVD and diabetes
- treatment for those with high absolute risk for CVD or diabetes (> 30%)
- treatment of new cases of acute myocardial infarction with aspirin
- treatment of cases of established ischaemic heart disease and post-myocardial infarction
- treatment of cases of established cerebrovascular disease and post-stroke
- standard and intensive glycaemic control

4

Methods

4. Methods

A multidisciplinary team comprising staff from the Thai Ministry of Public Health, the United Nations Inter-Agency Task Force on the Prevention and Control of Non-communicable Diseases, Chulalongkorn University, Mahidol University, WHO and UNDP developed a three-tier economic NCD investment case, complemented by an institutional context analysis, in February-September 2021. The team consisted of health economists, epidemiologists and experts in social development and public health.

This section outlines the methods and economic models used at various stages of the economic analysis:

- calculation of the economic burden of NCDs in terms of direct and indirect costs (absenteeism, presenteeism and premature death) and the economic burden of risk factors for NCDs;
- costing of clinical and policy interventions;
- estimation of the health impact of scaling up interventions; and
- an ROI analysis.

The methods used to analyse the institutional and context are also described. The data used are for 2019, in order to eliminate the impact of the COVID-19 pandemic on the results, by its impact on the size of the active labour force, GDP, disease prevalence and other factors.

Calculation of the economic burden of NCDs

A disease impacts on society not just through its contribution to premature death and ill-health, but also through its impact on the economy. During the establishment of the United Nations Inter-Agency Task Force, WHO and UNDP developed a model for calculating the economic burden of NCDs in a country, which allows for the estimation of current direct and indirect costs of NCDs. Principal inputs for determining the economic burden were incidence rates by age and sex for heart attacks and stroke and the prevalence by age and sex of diabetes, hypertension, chronic respiratory disease, and cancer. Mortality rates by age and sex were identified for each condition. Other demographic and economic indicators were also collected for use in the model, including population, GDP and labour statistics, from the National Statistical Office and the Bank of Thailand.

The economic burden of disease consists of two components, direct and indirect costs, which were estimated as follows. “Direct cost” refers to spending in response to or for prevention of a disease or disease group. For this component, health expenditure on NCDs in Thailand is needed. As the latest National Health Accounts exercise was conducted in 2016, spending for each NCD in the most recent year was estimated as a constant fraction of that year’s total health expenditure, adjusted for more recent values of spending on health. Estimation of the “indirect costs” of NCDs was based on estimates of the impact of each disease on the productive labour force, as a product of a the number of workers absent from

work because of disease (absenteeism), workers who are less productive at work because of disease (presenteeism) and workers who cannot work because of disease (labour force withdrawal). The estimate is based on the annual value (in terms of economic output) of each full-time worker in Thailand, which in turn is based on GDP per employed person, defined as the country's GDP (THB 16.88 trillion in 2019 current prices from the Bank of Thailand) divided by the total employed labour force. Local data on the total labour force aged ≥ 15 years, the unemployment rate and labour force participation rate were used to determine the total employed labour force in Thailand. The labour force was considered to include those working in both the formal and the informal sectors.

The extent to which NCDs reduce worker productivity was also considered. Rates were found in the academic literature (81–85) of the reduction in labour force participation due to hypertension, stroke, acute myocardial infarction, diabetes, cancer, chronic obstructive pulmonary disease (COPD) and lung disease; the reduction in full-time hours worked due to absenteeism; and the reduction in productivity due to presenteeism.

The number of people of working age with NCDs in Thailand was determined from demographic data, disease prevalence data, unemployment data and mortality records. From this, we subtracted those who chose not to participate in the labour force or were unemployed, those who could not participate in the labour force specifically because of their NCD and those who had died. This yielded the number of active workers with NCDs. The relative costs of absenteeism and presenteeism for surviving active workers with NCDs were then calculated, and this cost was added to the economic value of lost supply of labour, based on the numbers of workers who had died from NCDs in the last year, and would-be workers who could not participate in the labour force, or were forced to withdraw from the labour force, because of an NCD. This calculation resulted in the total indirect cost of each NCD. for the latest year available.

The economic burden was also estimated according to the major risk factors for NCDs, namely harmful use of alcohol, tobacco use, poor diet, insufficient physical activity, as well as air pollution. As the latest data on deaths, incidence and prevalence of NCDs attributable to risk factors in Thailand stem from 2014 (*86*) and were found to be incomplete for the NCDs included in this investment case, we used the database of the Global Burden of Disease project (*87*), which provides estimates of deaths and DALYs for specific diseases that are attributable to risk factors, by country. For mortality, the number of deaths attributable to a specific risk factor–disease combination was adjusted down by the total number of deaths due to disease in Thailand, modelled in the Global Burden of Disease project, divided by the official number of deaths by disease in the most recent year.[6]

6 Estimates of the Global Burden of Disease project are based on regional epidemiological models, and the estimates of the number of deaths due to NCDs are consistently higher than those in official reports. As a result, without this adjustment, mortality by risk factor could end up larger than the total official number of deaths by NCD in the country. Furthermore, as the population of Thailand used differed from the latest official figures, mortality estimates were also adjusted.

As the burden of NCD risk factors should be equal to, or smaller than, the economic burden due to NCDs, the impact of these risk factors was limited to their relation to the NCDs covered. While many other diseases and conditions are affected by these risk factors, such as mental health disorders as a result of hazardous alcohol use, these links were excluded to maintain comparability with the numbers noted above. Furthermore, the estimates presented are based on a single attribution of disease and premature mortality due to single risk factors, although risk factors often interact and have compounding (or competing) effects on diseases. No adjustment was made for this possibility.

Costs of policy and clinical interventions

The burden of NCDs must be addressed by scaling up existing NCD policy and clinical interventions. Therefore, the cost of delivering each intervention to each relevant population can be modelled, based on the additional population (relative to the status quo) that would receive it. To do this, we applied the WHO NCD Costing Tool (*88*) and the OneHealth Tool (*24*). The costing tool allows identification, quantification and evaluation of each resource required for policy and programme interventions, including meetings, mass media campaigns (such as on television or radio and in newspapers) and miscellaneous goods required to enact policies and programmes. For clinical interventions, the OneHealth Tool includes assumptions set by experts on the quantities of the inputs required.

For both clinical interventions and NCD policies, the prices of most items were taken from the WHO-CHOICE database (*89, 90, 91*) or from price data contained in the OneHealth Tool (*24*), inflated to current prices, while the prices of many inputs, which vary by country, such as media time, health sector salaries and per diems, were identified in official public sources, including Thai Government gazettes, the Office of the Civil Service Commission and the Human Resources Division of the Office of the Permanent Secretary of the Ministry of Public Health.

Return on investment

ROI is a measure of performance used to evaluate the economic value of future investments. It is a ratio of the value of the benefits stemming from an investment to the costs of that investment. In assessing health interventions, it is used to compare the magnitude (and timing) of benefits directly with the magnitude (and timing) of investment costs. Future costs and benefits are discounted, as a unit of currency in the future is worth less than that unit today owing to the time–value of money. An Excel®-based model developed by WHO, and adjusted by the authors, was used to estimate the relative economic gains that accrue from investing in different sets of cost–effective NCD interventions.

To determine the ROI, the costs of investing in NCD interventions, as estimated in the previous section, are compared with the economic benefits arising from those investments. The economic benefits are directly proportional to the overall health impact of implementing or scaling up the interventions due to their impact on labour productivity and, eventually,

economic output or GDP. The calculation begins with identification of the populations and their different health states that are affected by an NCD risk factor. Scaling-up of an intervention is then modelled either as adjusting down a risk factor (e.g., reducing hazardous alcohol use), as directly affecting the health of an individual (e.g., a physical activity policy that changes an individual's behaviour so that their cholesterol and blood pressure are lowered) or as the number of individuals whose health state does not move into a worse state (e.g., reducing the number of individuals with diabetes who develop retinopathy as a result of receiving insulin). As interventions change these parameters, the projected incidence and prevalence of NCDs are reduced, which contributes to decreasing absenteeism and presenteeism in the labour force. The first component of the economic benefits of investing in NCD interventions can be estimated by combining the relative average productivity per worker (GDP per employed person) and the reductions in rates of absenteeism and presenteeism.

The second component of the economic benefits of NCD interventions is their impact on the size of the labour force. As scaling up policies and interventions will lead to modelled decreases in mortality attributable to NCDs and decreases in the incidence and prevalence of NCDs, the expected avoided decreases in the labour supply can be estimated. A policy that prevents a certain number of individuals from smoking will prevent some of them from developing CVD and prevent a subset of those people from dying within the next 15 years, so that those who would have died and some of those who would have been too sick to work are kept in the labour force. By adding the number of avoided premature deaths in the active labour force as a result of policy implementation to avoided withdrawals from the labour force due to prevented incidence of disease, we were able to estimate gender- and age cohort-specific numbers of people whose participation in the labour force is not lost as a result of investments in NCD interventions. For each cohort, we then calculated the number of additional years of working life that would not be lost due to death or illness, which, together, yield the expected total lifetime income not lost due to NCDs. It should be noted that we did not assume that saving a 30-year-old man's life will automatically yield 35 more years of healthy labour, as a 30-year-old man has a non-zero chance of dying before he turns 65. We therefore adjusted down the number of years of working life by the gender- and age-specific annual probability of dying as individuals progress through their working years.

The projected economic gains from implementing NCD interventions are therefore the sum of avoided presenteeism, avoided absenteeism and avoided decreases in the labour force, accrued over the next 15 years.

ROIs for risk-factor-structured policy packages and the NCD clinical package were estimated by dividing the economic impact of each package by the total cost of setting up and implementing the interventions in each. This ratio was estimated for projected 5- and 15-year periods, which were adjusted with the "net present value" approach to future costs and economic gains, with 3% annual discounting of future costs and benefits.

Institutional context analysis

The economic analysis was complemented by an analysis of institutional context. The analysis provides advocacy-based recommendations to improve the likelihood that the numbers and policy options from the economic analysis are heard, understood and acted upon. For Thailand, the institutional context analysis was based on a desk review of sources including national strategic and policy documents, country reports by specialized United Nations agencies and other development partners, academic research articles, national and international statistical data repositories and consultations with national stakeholders on challenges, priorities and opportunities for action. The insights gained were used as the basis for the findings and conclusions of this report. More detailed information on institutional context analysis for investment cases is available in Noncommunicable disease prevention and control: a guidance note for investment cases (*25*).

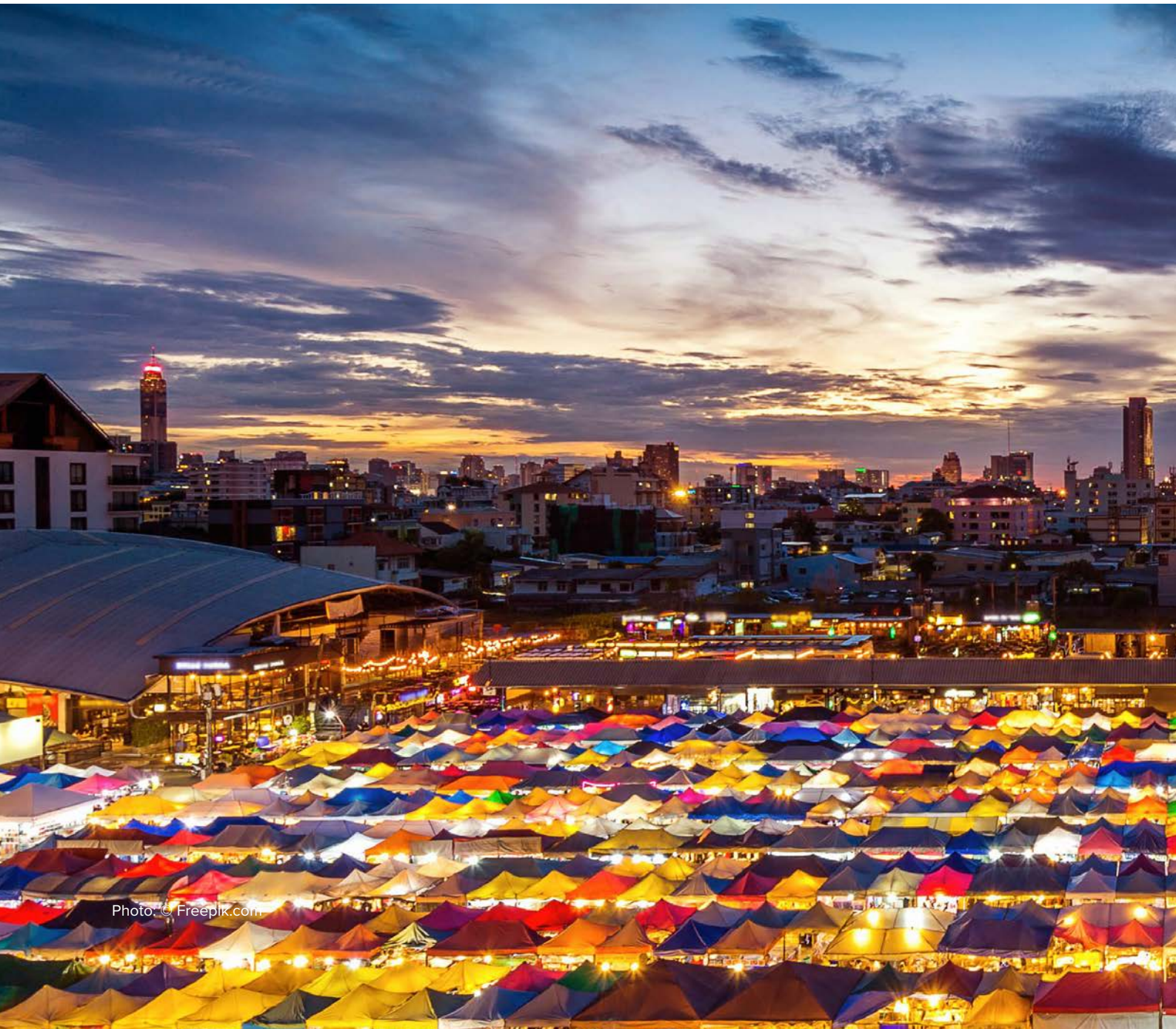


Photo: © Freepik.com

"The Royal Thai Government is committed to invest more in health promotion options that make healthy choices easily available and accessible to people." (10)

5

Results

5. Results

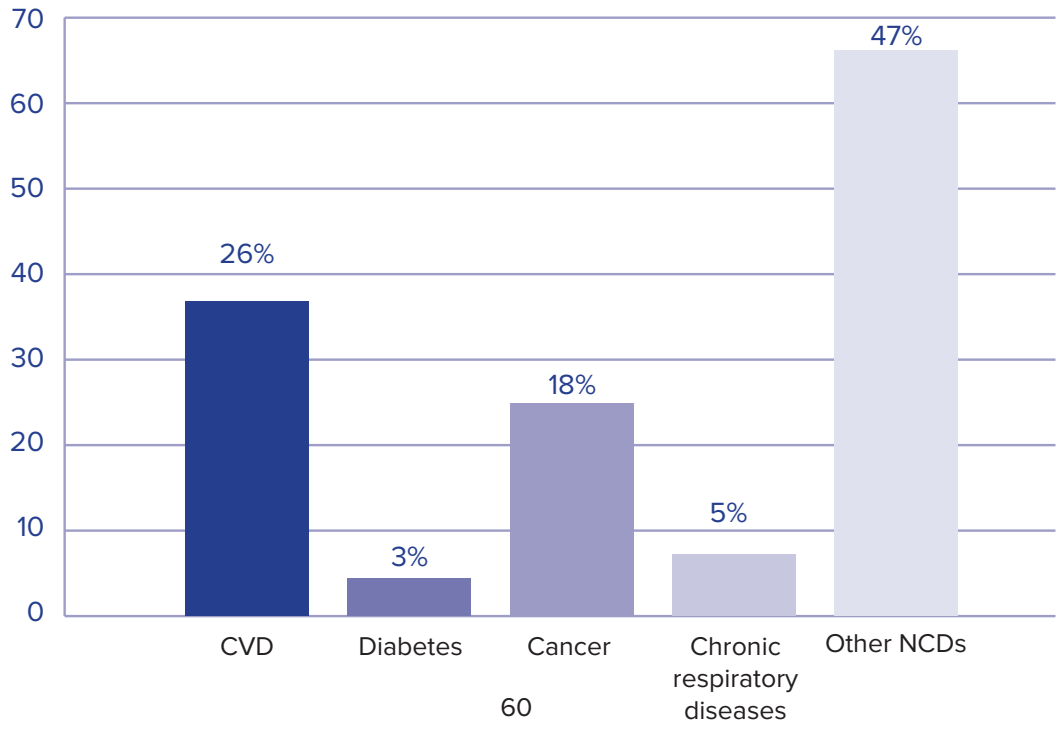
This section presents the results of the quantitative analyses of the NCD Investment case: the economic burden of NCDs and their risk factors, the costs of scaling up and implementing the policy and clinical intervention packages, their economic and other benefits and the resulting ROI ratio for each package.

Economic burden of NCDs

Direct costs

The direct costs of NCDs are related to direct spending on NCDs in a country. In Thailand, the estimate of direct costs included only public health-care expenditure and not private expenditure, such as out-of-pocket spending, or non–health care costs, such as for transport. As noted in the methods section, spending by disease was available only for 2016, and the share of spending by disease was assumed to have remained constant since then. Given the progressive increase in the NCD burden and increasing recognition of NCDs as a health problem in Thailand, this is definitely an underestimate; however, in the absence of a better reference point, this approach was considered as acceptable. In 2016, when the latest National Health Accounts exercise was conducted, total health expenditure was THB 593.9 trillion. Spending by disease area and by specific diseases was also reported, which showed that 23.5% of total health spending was public spending on NCDs and that spending on CVD, diabetes, cancer and COPD amounted to approximately 26%, 3%, 18% and 5% of that amount, respectively. Application of those ratios to the most recent estimate of total health expenditure (2018) yields a more recent estimate of direct spending on NCDs, as summarized in **Fig. 2.**

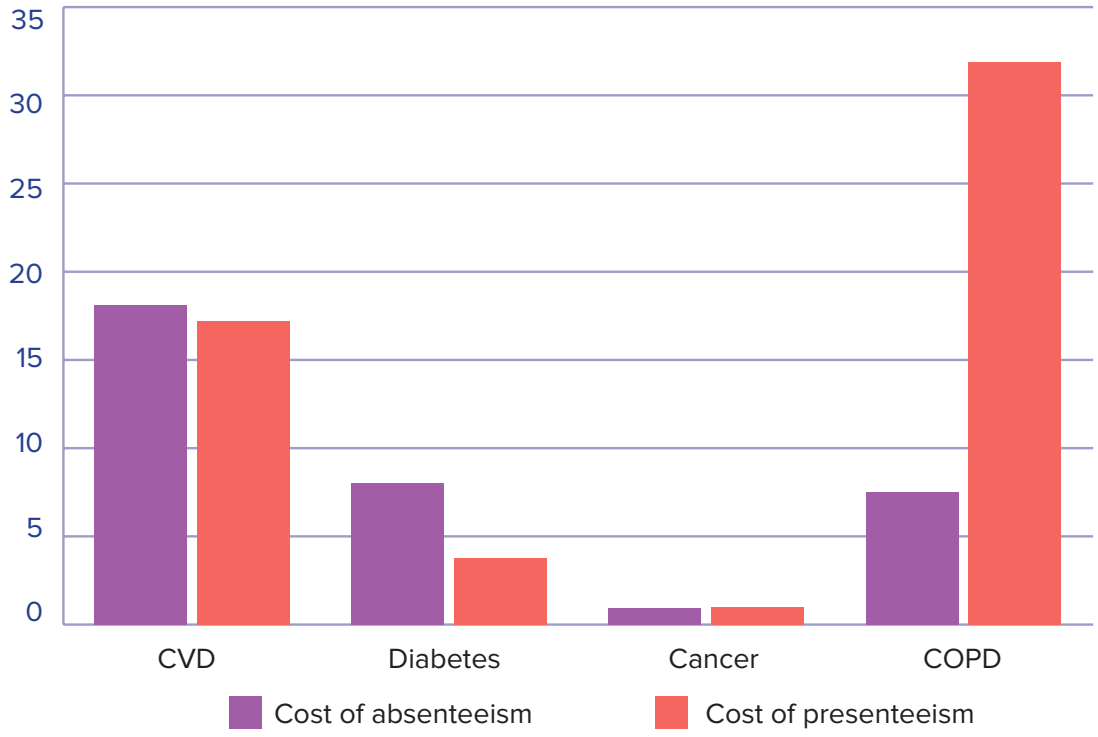
Fig. 2. Public health-care expenditure on NCDs, 2018, billion THB



Indirect costs

Indirect economic losses due to NCDs were modelled from increased absenteeism and presenteeism and losses from premature deaths. These were calculated with the human capital method. As noted in the methods section, calculation of absenteeism and presenteeism due to NCDs is based on the proportion of the workforce with NCDs that survived them. These are summarized in **Fig. 3**.

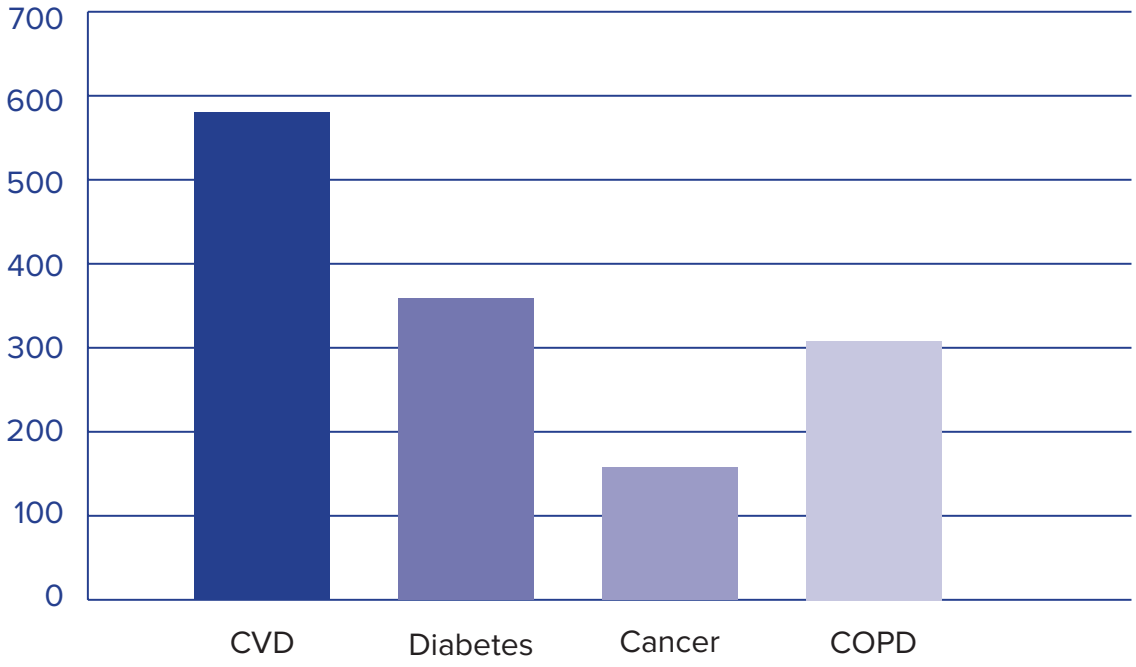
Fig. 3. Costs of absenteeism and presenteeism for NCDs, 2019, billion THB



The costs of a shrinking labour pool as a result of premature death or forced early withdrawal from active work were estimated from the expected foregone economic output, equivalent to the total income that would have been generated by workers during their lives until they reached retirement age. These costs were calculated by multiplying the GDP per worker by the labour force participation rate, i.e., the employment rate by the years of productive life lost due to either premature death or forced premature withdrawal from work.

As seen in **Fig. 4**, CVD is the costliest of the four NCDs in terms of labour force impact, followed by diabetes. Chronic respiratory disease is not a leading cause of decreased labour supply but is associated with high presenteeism.

Fig. 4. Economic burden of decreased labour supply, for four NCDs, 2019, billion THB



Total economic burden

Table 8 shows the total direct and indirect costs of NCDs in Thailand. The indirect economic losses are much higher than the direct losses. While the estimated public expenditure on the four main NCDs is already THB 139 billion, additional losses to the economy from absenteeism, presenteeism and labour force withdrawal amount to THB 1495 billion.

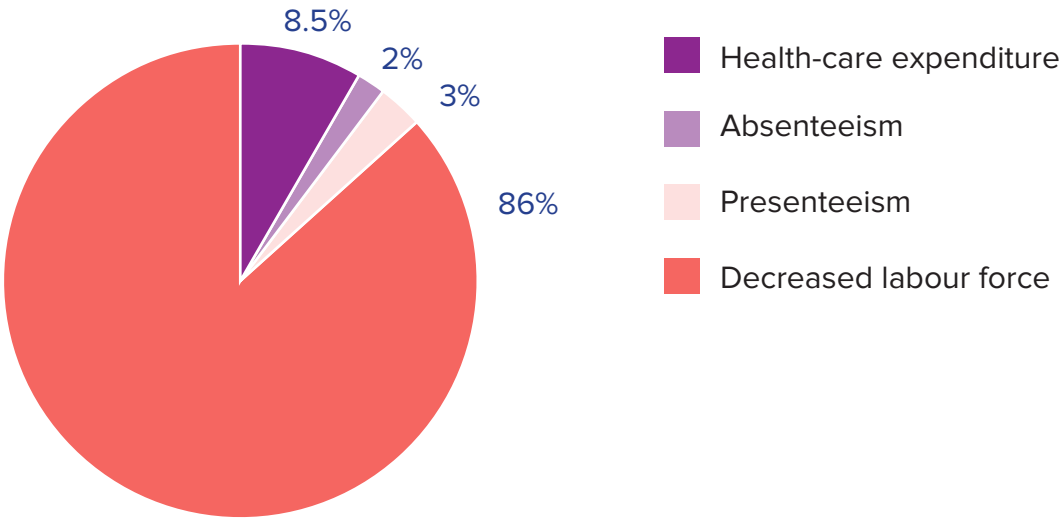
Table 8. Total economic burden of NCDs, by cost type, 2019, billion THB

Cost	CVD	Cancer	Diabetes	Chronic respiratory diseases	Other NCDs	Total	Total as % GDP
Direct costs							
Health spending*	36.8	24.9	4.4	7.2	66.1	139.3	0.8
Total direct costs	36.8	24.9	4.4	7.2	66.1	139.3	0.8
Indirect costs							
Absenteeism	18.0	0.9	8.0	7.5	NA	34.6	0.2
Presenteeism	17.2	1.0	3.8	34.9	NA	56.9	0.3
Premature withdrawal from work	580.4	157.8	359.3	309.2	NA	1406.8	8.3
Total indirect costs	615.7	159.8	371.1	351.6	NA	1498.2	8.9
Total	652.5	184.6	375.5	358.8	66.1	1637.5	9.7
Total as % GDP	3.9	1.1	2.2	2.1	0.4	9.7	

NA, not available, * Values are 2018 costs, but combined with 2019, as more recent estimates are not available

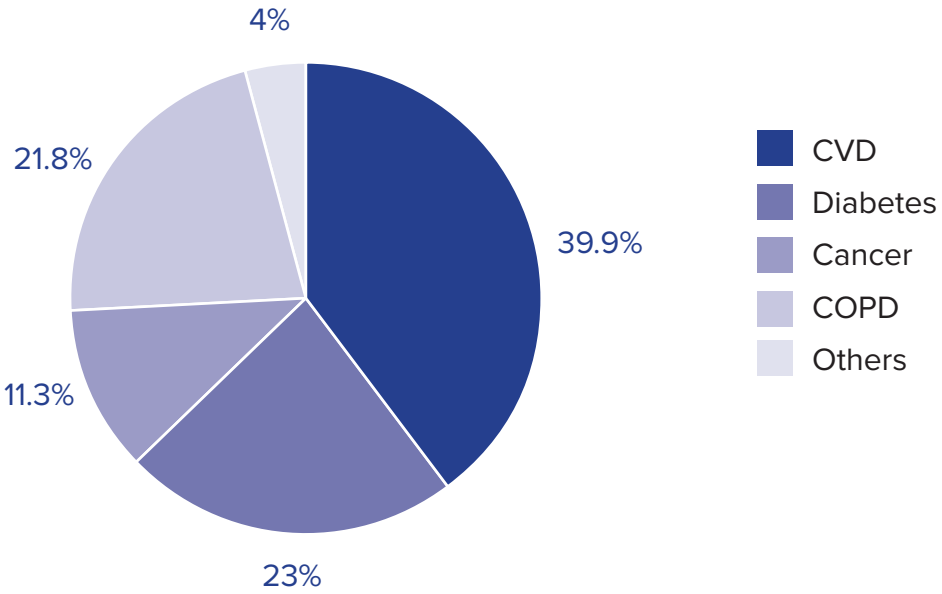
The total economic burden of NCDs on the Thai economy is THB 1635 billion, equivalent to 9.7% of GDP in 2019. **Fig. 5** shows the structure of the economic burden of NCDs. Health-care expenditure represents only 8.5% of all NCD-related costs.

Fig. 5. Structure of the economic burden of NCDs, Thailand, 2019



The economic burden by disease shows the distribution illustrated in **Fig. 6**, where cardiovascular disease represents the largest burden, followed by diabetes and COPD.

Fig. 6. Structure of the economic burden of NCDs, by disease, Thailand, 2019



Economic burden by risk factor

As spending can be attributed and segregated according to disease but not according to their risk factors, only the indirect costs of the economic burden of risk factors were estimated. Risk factors are related to all the NCDs considered; however, the Global Burden of Disease Project does not assume that they are all related.

Table 9 shows the costs attributable to NCD risk factors in Thailand. Ambient air pollution represents a much larger health and economic burden on the Thai population than household air pollution.

Table 9. Total economic burden of risk factors for NCDs, by cost type, 2019, billion THB

Risk factor	Ambient air pollution	Household air pollution	Harmful use of alcohol	Tobacco use	Unhealthy diet (high sodium)	Insufficient physical activity
By cost type						
Absenteeism	2.8	0.8	2.4	5.6	3.2	0.5
Presenteeism	6.0	1.8	2.3	17.0	3.0	0.2
Premature withdrawal from work	154.9	35.2	88.5	329.3	94.6	20.7
By disease	18.0	0.9	8.0	7.5	NA	34.6
CVD	19.4	4.7	72.5	20.8	100.1	0.9
Diabetes	57.3	16.6	2.9	61.6	0	20.2
Cancer	4.4	1.1	17.8	26.5	0.6	0.3
COPD	82.7	15.5	0	243.1	0	0
Total	163.8	37.7	93.2	352.0	100.8	21.4

The following definitions were used to estimate these results (from references *24* and *87*) and the related morbidity and premature mortality. Ambient and household air pollution: percentage of the population with long-term exposure to air of a quality below clean air standards. Hazardous alcohol use: Percentage of people who consume ≥ 21 drinks/week for men (or ≥ 7 drinks per occasion at least three times a week) and ≥ 14 drinks/week for women (or ≥ 5 drinks per occasion at least three times a week). Tobacco use: Percentage of individuals who smoked at least once in the past month. Unhealthy diet: not overconsumption of salt but impact on NCDs of mean sodium intake per day. Insufficient physical activity: not doing ≥ 30 min/week of moderate-intensity exercise.

Costs of action

The costs of scaling up (or introducing) NCD policies or clinical interventions were estimated for the period 2021–2036. **Table 10** shows the costs for each of the first 5 years of this period plus the 5-year and 15-year totals. The cost of planning certain policies, such as mass media campaigns and protecting people from smoking, is high, reflected in the high costs in the initial years. The "All policy interventions" is the scenario in which all NCD policies included are implemented and scaled up.

Table 10. Estimated costs of scaling up policy and clinical interventions, billion THB

Intervention type	2021	2022	2023	2024	2025	Total for 5 years[a]	Total for 15 years[a]
Tobacco control package	2.83	3.21	3.35	3.39	3.41	14.45	37.56
Alcohol control package	3.82	5.51	5.06	5.17	5.29	22.16	66.87
Physical activity awareness package	0.14	0.19	0.19	0.20	0.21	0.84	3.10
Salt reduction package	0.56	0.52	0.38	0.67	0.67	2.79	9.52
All policy interventions, total	7.35	9.43	8.98	9.43	9.58	38.26	109.31
Clinical intervention package	0.00	1.43	2.81	4.24	5.69	12.21	101.47
Total	7.35	10.86	11.79	13.67	15.37	50.47	210.78

a Totals for 5 and 15 years adjusted to reflect discounting of future costs.

Non-economic (health) benefits

Scaling up and implementing NCD interventions improve population health, prevent new cases of NCDs and acute CVD events and prevent premature mortality (**Table 11)**. It can also be seen that all the packages are expected to reduce the number of lives lost to CVD-related causes significantly. In addition to the risk-factor-specific policy packages, a package of all the policies was also modelled. Alcohol-related policies are expected to have the greatest impact (114 764 lives saved), and scaling up the clinical care package would be expected to save nearly 100 000 lives.

Table 11. Estimated health benefits over 15 years

Intervention package	Strokes averted	Acute ischaemic heart disease cases averted	Diabetes cases averted	COPD cases averted	Cancer cases averted[a]	Deaths averted	Healthy life-years gained
Tobacco interventions	45 760	18 205	36 770	78 382	0	35 790	348 768
Alcohol interventions	1 355	27	0	0	0	114 764	5 871 283
Physical activity interventions	5 456	5 377	0	0	0	5 550	45 039
Salt interventions	125 337	33 830	0	0	0	63 137	548 968
Policy interventions[b]	164 947	53 725	36 770	78 382	0	210 553	6 731 479
Clinical interventions	95 189	51 981	0	0	93 414	99 120	913 434

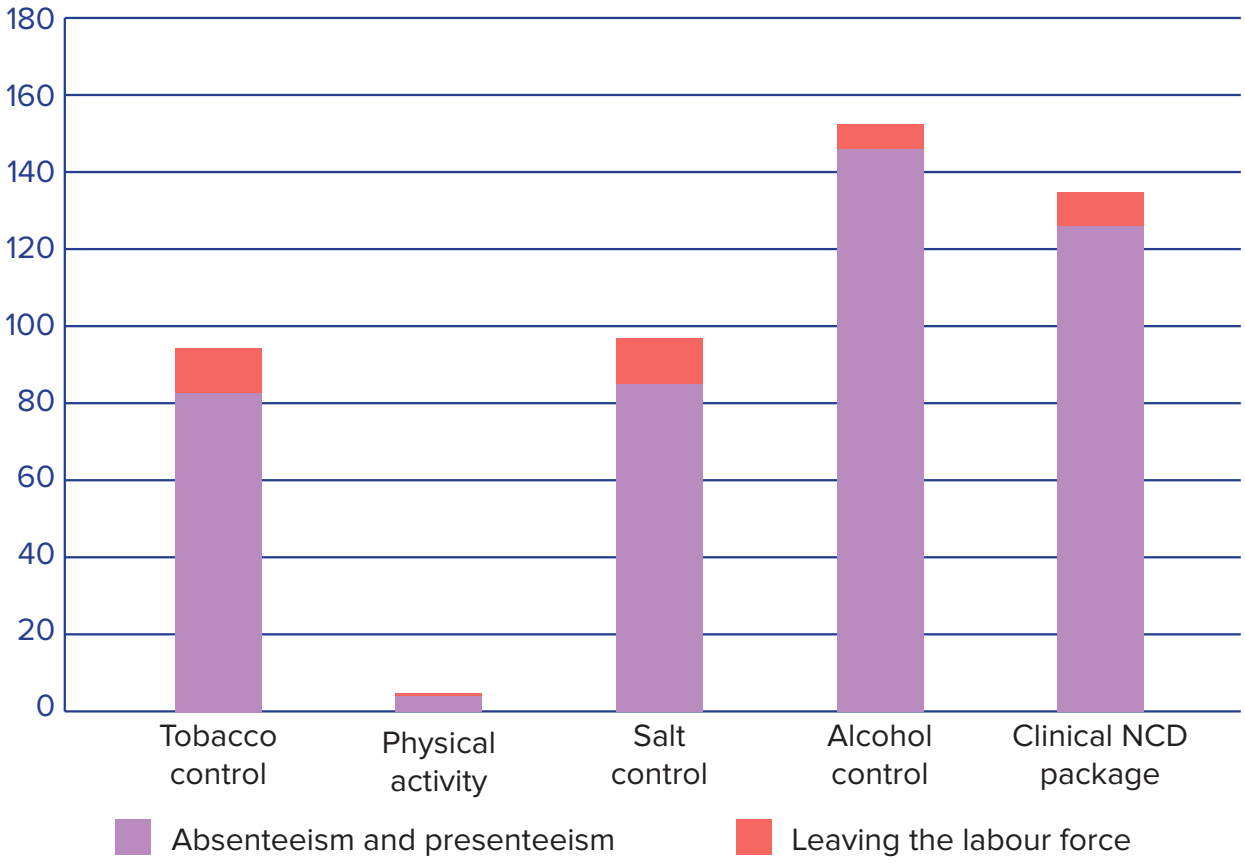
a Cases of stage 3 and 4 of breast, cervical, colorectal and lung cancer
b Scaling up each package separately results in higher estimates than for a package of all policies, as some of the policy interventions would affect the same individuals.

Each set of packages also adds healthy life-years to the population. For instance, clinical interventions and the tobacco policy package will prevent strokes and other cardiovascular events; thus, individuals will avoid disabling states (such as partial paralysis from stroke) that can increase pain and suffering, reduce mobility and impair speech and thought. Alcohol policies, particularly those to prevent drinking at an early age and prevent morbidity that would last a lifetime, are expected to have the highest impact on healthy life-years.

Economic benefits

Individuals with NCDs often take time off work to seek care or because they are too ill to work (absenteeism) and find that they have reduced productivity while at work (presenteeism). In addition, those who are too ill to work or die from an NCD represent a loss of all future work they would have been able to do had they not been ill. Scaling up policy and clinical interventions brings health benefits and contributes to creating economic benefits by saving lives, preventing cases of disease, contributing to avoided absenteeism and presenteeism and, most importantly, averting withdrawal from the labour force. **Fig. 7** illustrates the importance of "saved human capital" by preventing death and disease in the working population over the next 15 years.

Fig. 7. Recovered economic output expected by implementing tobacco control, physical activity, salt control, alcohol control and clinical intervention packages over 15 years



The greatest positive impact on productivity is that of the alcohol package, followed by the clinical package. The relative reductions in absenteeism and presenteeism are much smaller than that of ensuring that people do not have to leave the labour force earlier than planned.

Return on investment

Comparing the costs and benefits of each package of interventions shows that they all have an ROI > 1.2. This means that, for every THB invested in any of these areas, there will be more than an equal impact on the Thai economy (**Table 12**).

Table 12. Costs, benefits and ROI at 5 and 15 years, by intervention package (billion THB)

Intervention package	5 years[a]			15 years[a]		
	Total cost	Total productivity benefits	ROI	Total cost	Total productivity benefits	ROI
Tobacco	14.45	20.83	1.44	37.56	94.97	2.53
Alcohol	22.16	58,57	2.64	66.87	152.56	2.28
Physical activity	0.84	1.41	1.68	3.10	5.63	1.82
Salt	2.79	15.63	5.60	9.52	97.71	10.26
All policies	38.26	81.84	2.07	109.31	302.59	2.71
Clinical interventions	12.21	8.79	0.72	101.47	126.87	1.25

a Net-present values, with values adjusted to discount future costs and benefits

Policy packages (salt reduction, tobacco and alcohol control and physical activity) are the clear best buys from an economic perspective, offering the highest ROIs over 15 years. The package of clinical interventions may have the lowest ROI, but it still requires future Investment. The ROI is low, because treating disease instead of preventing it can be relatively expensive, and options for addressing certain NCDs, such as care after acute CVD events, have significant health benefits but low potential to increase labour force participation. Scaling up clinical care is not only a smart financial investment but is also critical to provide the Thai population with the necessary health services, in line with the health SDGs and the pledge to leave no one behind.

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6

Conclusion and recommendations

6. Conclusion and recommendations

The four major NCDs have a significant negative impact on the Thai economy, requiring significant public spending and limiting the size and productivity of the labour force. They also slow the country's broader development priorities of increasing human capital and strengthening inclusive economic growth. NCDs are a leading health and development challenge in Thailand, and they are making the COVID-19 pandemic worse and vice versa. Addressing NCDs and COVID-19 together can reduce the health and economic burdens of both.

The findings of this analysis show that NCDs cost the Thai economy THB 1637 billion (US$ 50 billion) in economic losses in 2019, equivalent to 9.7% of the GDP. Investment in proven, cost–effective intervention packages (WHO best buys) can significantly reduce the burdens of cardiovascular disease, cancer, chronic respiratory disease and diabetes, thereby increasing labour productivity and making the Thai society more resilient to future pandemics. Furthermore, these best buys can increase people's life expectancy and quality of life while decreasing the burden on the national economy, thus accelerating economic growth. These investments therefore contribute to the overall socioeconomic development of the country and achievement of the SDGs.

In this investment case, we assessed selected population and clinical interventions for the prevention and control of NCDs. Both types of intervention will yield a favourable ROI. Investment in the salt reduction package is expected to result in the greatest return (> THB 10 in return over 15 years for every THB invested). Apart from economic benefits, the expected health benefits of scaling-up policy and clinical interventions over 15 years include prevention of thousands of new cases of NCDs and saving over 300 000 lives.

The high returns estimated in this report understate the case for increased investment, as they refer only to the economic benefits of improved health outcomes and do not account for the significant additional revenue from the recommended increases in excise tax rates on health-harming products such as tobacco, alcohol and sugar-sweetened beverages, which may be significantly higher than the cost of implementing the recommendations. In other words, these policies are expected to both raise money and save lives.

Given the significant health and economic burden of NCDs on Thailand, this report suggests that further implementation of population and individual NCD prevention policies would deliver substantial ROIs. Implementation of the intervention packages will require structured engagement from sectors beyond health, such as finance, economy and trade, and the benefits of investment would accrue to the whole of Government and society. NCD prevention and control are expected to have direct and indirect impacts on achievement of all the SDGs, especially on poverty reduction (SDG 1), population health (SDG 3), decent work and economic growth (SDG 8), reduction of inequalities (SDG 10), sustainable cities and communities (SDG 11) and strong institutions (SDG 16).

Recommendations

It is strongly recommended that Thailand immediately implement and enforce the policies modelled in the investment case and strengthen advocacy, coordination, planning and financing for development. The institutional and context analysis identifies the following additional actions.

1 Advocate for additional increases in taxes on health-harming products and introduction of subsidies for healthy products.

The use of fiscal measures to address NCDs by increasing tax rates on health-harming products is a promising approach for financing scaled-up action on NCDs. Increasing taxes on health-harming products reduces the consumption of such products, thereby improving population health and reducing the associated costs while increasing Government revenue for national development priorities. Effective "health taxes" require the ministries of finance and health to work together and benefit from broader whole-of-government support.

- Continue to simplify the cigarette tax system by closing the gaps between tiers and substantially increasing the tax on roll-your-own tobacco products, as part of a long-term plan for gradual increases.
- Enforce the local tobacco tax measures of the Bangkok Metropolitan Administration to prevent tax avoidance.
- Progressively increase the tax on sugar-sweetened beverages, as mandated in the Excise Act 2017.
- Ensure that standard tax rates are applied to all alcoholic beverage categories, and increase the excise tax regularly, taking inflation and income growth into account.
- Discourage unhealthy diets and encourage food reformulation by introducing taxes on junk food and foods with excessively high levels of salt, sugar and saturated fats.
- Consider tax measures to promote healthy behaviour, such as a 50% reduction in the excise tax on fruits and vegetables (*92*).

2 Strengthen enforcement of preventive NCD regulations to ensure accountability among sectors and levels.

Stronger enforcement is necessary, particularly of bans on the availability of alcohol and e-cigarettes, access to smoke-free places and prevention of the sale of tobacco and alcohol to and by minors. Lack of resources and a fragmented regulatory framework are barriers to stronger enforcement of tobacco and alcohol control measures.

- Strengthen infrastructure for policy implementation and resource mobilization for NCD prevention and control.
- Strengthen tobacco and alcohol control committees by ensuring adequate staffing and resources at provincial level.
- Sensitize provincial and district leadership about national laws on tobacco and alcohol control, with clear responsibilities and coordination of the work of enforcement officers.
- Use local taxes from alcohol and tobacco to support tobacco and alcohol control, including training officials in all relevant ministries.
- Use the budget for public–private partnerships to support implementation of NCD regulations and national strategies.

Photo: © UNDP

3 Implement novel policies to improve access to safe, nutritious food for all.

Given the rising trends in obesity, diabetes and hypertension and in the context of following up the United Nations Food Systems Summit in September 2021 (*93*), access to healthy nutrition for all must be increased urgently.

- Ban the sale of carbonated and sugary drinks and unhealthy foods in and around schools.
- Replace unhealthy snacks in school lunches with healthy options such as local, seasonal fruits.
- Set maximum levels of sodium in food categories as per WHO benchmarks.
- Introduce procurement policies for schools and public and private institutions to ensure consumption of healthy foods low in sugar, salt and saturated fats, with large amounts of fruit and vegetables.
- Introduce more effective front-of-package labelling, including warning labels on excessively sugary, salty and high-calorie foods, to discourage consumption of ultra-processed foods.
- Continue to monitor enforcement of the trans-fat ban through surveillance of partially hydrogenated oils.

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4 Prevent interference from the tobacco, alcohol, air polluting and food industries to ensure that the public interest supersedes commercial interests.

The alcohol, tobacco, air polluting and food industries have vested interests in fiscal and regulatory policies on the sale and distribution of health-harming products. Interference by industry has been identified as one of the major challenges to NCD prevention and control in Thailand. It involves both attempts to influence policy-making and the spread of myths and false information to consumers to mislead them about the health effects of certain products. These activities must be countered by consistent implementation of measures by all relevant Government bodies.

- Develop and disseminate official guidelines for national ministries and other public bodies to define appropriate code of conduct in relation to the alcohol, tobacco and food industries.
- Organize workshops or sectoral briefings to raise awareness in other ministries about the risk and implications of industry interference in national NCD prevention and control.
- Establish a multi-partner group led by academia or civil society to monitor industry interference and to release the information publicly at regular intervals.
- Use the budget for public–private partnerships to support implementation of NCD regulations and national strategies.

Photo: © Freepik.com

5 Strengthen national leadership, coordination and accountability for preventing and controlling NCDs.

- Ensure that a high-level inter-ministerial committee on NCD prevention and control, with designated operational staff, meets regularly to plan, coordinate and review actions for implementation of the national multisectoral NCD plan by different sectors.
- Track progress in implementing national NCD policies and targets, and release the data publicly at regular intervals.
- Increase the capacity of the leadership, the staff and the resources of the NCD Division of the Ministry of Public Health to convene multisectoral partnerships, track progress in all sectors and communicate information regularly to the public and policy-makers.

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6 Support the work of champions and agents of change.

Champions and NCD leaders have played key roles in advancing health goals in Thailand by mobilizing political and social capital, combatting industry interference and finding creative strategies. Champions and NCD leaders should be supported and new national and local champions found to add momentum to the combat against NCDs.

- Recognize the invaluable work of champions and NCD leaders and support them in increasing their advocacy.
- Create and institutionalize a programme for identifying and nurturing champions, NCD leaders and agents of change, and build a network of champions and leaders for sustainable, collective NCD prevention and control in Thailand.
- Establish a "think tank" for knowledge management, knowledge exchange and policy communications.

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7 Develop a robust method for calculating the return on investment of a policy package to reduce ambient air pollution.

Build on the vast body of research and knowledge to promote effective policies to reduce air pollution. An investment case for these policies would be useful for advocacy.

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References

1. Noncommunicable diseases country profiles 2018. Geneva: World Health Organization; 2018 (https://www.who.int/nmh/countries/tha_en.pdf).
2. Bloom DE, Cafiero ET, Jané-Llopis E, Abrahams-Gessel S, Bloom LR, Fathima S et al. The global economic burden of non-communicable diseases. Geneva: World Economic Forum; 2011 (http://www3.weforum.org/ docs/WEF_Harvard_HE_GlobalEconomicBurdenNon-communicableDiseases_2011.pdf).
3. Suwanwela W, Vinyal L. Health financing for NCDs, presented at the SEA Regional forum to accelerate NCD prevention and control in the context of the SDGs, Bangkok, Thailand, 9 October 2017.
4. Thailand Is preparing for becoming a super-aged society. Bangkok: Thai Government Public Relations Department; 2020 (https://thailand.prd.go.th/ewt_news.php?nid=10055&filename=index).
5. Clark A, Jit M, Warren-Gash C, Guthrie B, Wang HHX, Mercer SW et al. Global, regional, and national estimates of the population at increased risk of severe COVID-19 due to underlying health conditions in 2020: a modelling study. Lancet Global Health. 2020;8(8):E1003–17.
6. Katewongsa P, Widyastari DA, Saonuam P, Haemathulin N, Wongsingha N. The effects of the COVID-19 pandemic on the physical activity of the Thai population: Evidence from Thailand's surveillance on physical activity 2020. J Sport Health Sci. 2020;10(3):341–8 (https://doi.org/10.1016/j.jshs.2020.10.001).
7. The impact of the COVID-19 pandemic on noncommunicable disease resources and services: results of a rapid assessment. Geneva: World Health Organization; 2020.
8. Horton R. Offline: COVID-19 is not a pandemic. Lancet. 2020;396(10255):874 (https://doi.org/10.1016/S0140-6736(20)32000-6).
9. NCD COVID-19 vulnerability dashboard (beta). New York City (NY): United Nations Development Programme; 2021 (https://public.domo.com/embed/pages/aOV4p).
10. Chan-O-Cha P. Thailand's commitment to global cooperation on NCDs: acting together now. Lancet. 2019;393(10166):11–3 (http://dx.doi.org/10.1016/S0140-6736(18)32347-X).
11. Allen LN, Nicholson BD, Yeung BYT, Goiana-da-Silva F. Implementation of non-communicable disease policies: a geopolitical analysis of 151 countries. Lancet Glob Health. 2020;8:e50–8.
12. Pongutta S, Suphanchaimat R, Patcharanarumol W, Tangcharoensathien V. Lessons from the Thai Health Promotion Foundation. Bull World Health Organ. 2019;97:213–20 (http://dx.doi.org/10.2471/BLT.18.220277).
13. Vehicles emitting black smoke to face fine up to Bt5,000, department warns. The Nation. 25 January 2021 (https://www.nationthailand.com/in-focus/30401750).
14. Phonsuk P, Vongmongkol V, Ponguttha S, Suphanchaimat R, Rojroongwasinkul N, Swinburn BA. Impacts of a sugar sweetened beverage tax on body mass index and obesity in Thailand: A modelling study. PLoS One. 2021;16(4):e0250841 https://doi.org/10.1371/journal.pone.0250841).
15. Freedman A. Thailand looks to implement salt tax in 2021. Fitch Solutions, 18 January 2021 (https://www.fitchsolutions.com/consumer-retail/thailand-looks-implement-salt-tax-2021-18-01-2021).

16. Boonlert T. Snacking towards bad health. Bangkok Post, 20 April 2021 (https://www.bangkokpost.com/life/social-and-lifestyle/2102371/snacking-towards-bad-health).
17. WHO, UNDP. United Nations Thematic Working Group on Noncommunicable Disease Prevention and Control – Case study: Thailand. Geneva: World Health Organization; 2021 (https://www.who.int/thailand/activities/un-thematic-working-group-on-noncommunicable-diseases-(ncds)-in-thailand
18. Noncommunicable diseases. Fact sheet. Geneva: World Health Organization; 2021 (https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases).
19. Preventing chronic diseases: a vital investment. Geneva: World Health Organization; 2005:18 (https://www.who.int/chp/chronic_ disease_report/part1/en/index11.html).
20. Global action plan for the prevention and control of noncommunicable diseases 2013–2020. Geneva: World Health Organization; 2013.
21. "Best buys" and other recommended interventions for the prevention and control of noncommunicable diseases. Geneva: World Health Organization; 2017 (https://www.who.int/ncds/management/WHO_Appendix_BestBuys.pdf?ua=1).
22. Preparation for the third high-level meeting of the General Assembly on the prevention and control of non-communicable diseases to be held in 2018. Report by the Director-General. Geneva: World Health Organization; 2017.
23. Saving lives, spending less: a strategic response to noncommunicable diseases. Geneva: World Health Organization; 2018.
24. OneHealth Tool. Glastonbury (CT): Avenir Health; 2021 (https://avenirhealth.org/software-onehealth.php).
25. WHO, UNDP. Noncommunicable disease prevention and control: a guidance note for investment cases. Geneva: World Health Organization; 2019.
26. Fact sheet 2018 Thailand. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/bitstream/handle/10665/272690/wntd_2018_thailand_fs.pdf?sequence=1).
27. Report on the global tobacco epidemic. Geneva: World Health Organization; 2021 (https://www.who.int/teams/health-promotion/tobacco-control/glo bal-tobacco-report-2021).
28. WHO global report on trends in prevalence of tobacco use 2000–2025, third edition. Geneva: World Health Organization; 2019 (https://cdn.who.int/media/docs/default-source/searo/tobacco/country-fact-sheets/thailand-who-tobacco-prevalence-trend-estimates-2019.pdf?sfvrsn=4030f0b3_2).
29. Protecting school children from the serious threat of non-communicable diseases. Geneva: World Health Organization; 2020 (https://cdn.who.int/media/docs/default-source/thailand/ncds/ncd-brief_school_children_22-nov.pdf?sfvrsn=69e053b4_3).
30. Tobacco atlas – Thailand. New York City (NY): American Cancer Society, Inc. and Vital Strategies; 2021 (https://tobaccoatlas.org/country/thailand/).
31. Over six thousand Thais die from secondhand smoke annually. Geneva: World Health Organization; 2017 (http://www.ashthailand.or.th/content_attachment/attach/press_-_over_six_thousand_thai.pdf).
32. Komonpaisarn T. Economic cost of tobacco smoking and secondhand smoke exposure at home in Thailand. Tob Control. 2021 (http://dx.doi.org/10.1136/tobaccocontrol-2020-056147).
33. Global Youth Tobacco Survey Thailand 2015. Geneva: World Health Organization; 2015 (https://extranet.who.int/ncdsmicrodata/index.php/catalog/225/download/1980).

34. Thailand Global School-based Student Health Survey 2021 (In Press).
35. E-cigarette usage in Thailand going up despite continued ban. The Phuket News, 7 September 2019 (https://www.thephuketnews.com/e-cigarette-usage-in-thailand-going-up-despite-continued-ban-72749.php).
36. Savigamin C, Jitwimungsanon J, Rattananupong T, Sittipunt C, Sriprasart T. Prevalence and risk factors of e-cigarette users in Thai college student. Clin Med Res. 2021;10(2):47–52. doi: 10.11648/j.cmr.20211002.13.
37. Thailand. Alcohol consumption: levels and patterns. Geneva: World Health Organization; 2018 (https://www.who.int/substance_abuse/publications/global_alcohol_report/profiles/tha.pdf).
38. Global status report on alcohol and health 2018. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/274603).
39. Global School-based Student Health Survey: Thailand 2015. Fact sheet. Geneva: World Health Organization; 2015 (https://extranet.who.int/ncdsmicrodata/index.php/catalog/554/related-materials).
40. Global status report on road safety. Geneva: World Health Organization; 2018 (https://www.who.int/publications/i/item/9789241565684).
41. Road traffic deaths and injuries in Thailand. Geneva: World Health Organization; 2019 (https://cdn.who.int/media/docs/default-source/thailand/roadsafety/overview-en-final-25-7-19.pdf?sfvrsn=f9d7a862_2).
42. Laohong K. Drink-driving makes up 95% of New Year probation cases. Bangkok Post, 7 January 2021 (https://www.bangkokpost.com/thailand/general/2047159/drink-driving-makes-up-95-of-new-year-probation-cases).
43. Olam K, Regan H. Why people keep dying on Thailand's roads, the most lethal in Southeast Asia. CNN, 4 January 2019 (https://edition.cnn.com/2019/01/03/asia/thailand-road-deaths-new-year-intl).
44. Aekplakorn W, editor. The 6th National Health Examination Survey 2019–2020. Nonthaburi: National Health Examination Survey Office, Health System Research Institute; 2021.
45. Marooko A. Bangkok schools remain open amidst air pollution crisis. Business Thailand, 17 December 2020 (https://businessthailandtv.com/index.php/2020/12/17/bangkok-schools-remain-open-amidst-air-pollution-crisis/).
46. Chailimpamontree W, Kantachuvesiri S, Aekplakorn W, Lappichetpaiboon R, Sripaiboonkij Thokanit N et al. Estimated dietary sodium intake in Thailand: A nationwide population survey with 24-hour urine collections. J Clin Hypertens. 2020;23(4):744¬–54 (https://doi.org/10.1111/jch.14147).
47. Sugar tax increase takes effect October 1st. National News Bureau of Thailand, 25 July 2019 (https://nbtworld.prd.go.th/en/news/detail/TCATG190725140806445).
48. WHO calls on countries to reduce sugars intake among adults and children. Geneva: World Health Organization; 2015 (https://www.who.int/news/item/04-03-2015-who-calls-on-countries-to-reduce-sugars-intake-among-adults-and-children).
49. Lessons learned from Thailand's obesity prevention and control policies. Washington DC: World Bank; 2018 (https://documents1.worldbank.org/curated/en/397481548340562764/pdf/Lessons-Learned-from-Thailands-Obesity-Prevention-and-Control-Policies.pdf).

50. Cardiovascular risk prediction charts. Geneva: World Health Organization; 2016 (https://www.who.int/cardiovascular_diseases/publications/Chart_predictions/en/).
51. Teerawattanon Y, Luz A. Obesity in Thailand and its economic cost estimation (ADBI Working Paper Series). Manila: Asian Development Bank; 2017 (https://www.adb.org/sites/default/files/publication/236536/adbi-wp703.pdf).
52. Thailand state of pollution 2020 (B.E. 2563). Bangkok: Ministry of Natural Resources and Environment, Pollution Control Department; 2021 (https://www.pcd.go.th/wp-content/uploads/2021/03/pcdnew-2021-04-07_06-54-58_342183.pdf).
53. Ambient (outdoor) air pollution. Factsheet. Geneva: World Health Organization; 2018 (https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health).
54. State of global air 2020. Boston (MA): Health Effects Institute. 2020.
55. Towards green growth in Southeast Asia (OECD Green Growth Studies). Paris: Organization for Economic Co-operation and Development; 2014 (http://dx.doi.org/10.1787/9789264224100-en).
56. Ambient air pollution attributable death rate (per 100 000 population). Geneva: World Health Organization, Global Health Observatory; 2021 (https://www.who.int/data/gho/data/indicators/indicator-details/GHO/ambient-air-pollution-attributable-deaths).
57. Pinichka C, Makka N, Sukkumnoed D, Chariyalertsak S, Inchai P, Bundhamcharoen K. Burden of disease attributed to ambient air pollution in Thailand: A GIS-based approach. PLoS One. 2017;12(12):e0189909 (https://doi.org/10.1371/journal.pone.0189909).
58. Fold NR, Allison MR, Wood BC, Thao PTB, Bonnet S, Garivait S et al. An assessment of annual mortality attributable to ambient PM2.5 in Bangkok, Thailand. Int J Environ Res Public Health. 2020;17(19):7298 (doi: 10.3390/ijerph17197298. PMID: 33036260; PMCID: PMC7578932).
59. Noncommunicable diseases progress monitor 2020. Geneva: World Health Organization; 2020 (https://www.who.int/publications-detail/ncd-progress-monitor-2020).
60. Progress tracker 2020 – Prevention and control of noncommunicable diseases (NCDs) Thailand. Geneva: World Health Organization; 2020 (https://cdn.who.int/media/docs/default-source/thailand/ncds/progress-tracker-2020-ncds-231120.pdf?sfvrsn=11e9539c_3).
61. Thailand. Universal health-care coverage scheme (ILO Social Protection Department Country Note Series). Geneva: International Labour Office; 2017 (https://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/publication/wcms_568679.pdf).
62. Global health expenditure database. Geneva: World Health Organization; 2020 (apps.who.int/nha/database).
63. What ministries of finance need to know about non-communicable diseases: A sectoral brief for Thailand. New York City (NY): United Nations Development Programme; 2020 (https://www.undp.org/sites/g/files/zskgke326/files/publications/UNDP-RBAP-NCD-Brief-Thailand-Finance-2020.pdf).
64. The Kingdom of Thailand health system review (Health Systems in Transition, Vol. 5 No. 5). Geneva: World Health Organization; 2015 (https://apps.who.int/iris/bitstream/handle/10665/208216/9789290617136_eng.pdf?sequence=1&isAllowed=y).

65. Situation of the Thai elderly 2016. Bangkok: Foundation of Thai Gerontology Research and Development Institute; 2016 (http://www.dop.go.th/download/knowledge/en1518139087-108_0.pdf).
66. 5-Year National NCDs Prevention and Control Plan (2017–2021). Nonthaburi: Policy and Stsrategy Section, Bureau of Non-communicable Disease, Ministry of Public Health; 2017 (https://www.who.int/docs/default-source/thailand/ncds/national-ncd-prevention-and-control-plan-2017-2021-eng.pdf).
67. Thailand twenty-year Strategy, 2018-2037. Bangkok: Office of the National Economics and Social Development Council; 2018 (http://nscr.nesdb.go.th/wp-content/uploads/2019/10/National-Strategy-Eng-Final-25-OCT-2019.pdf)
68. Report on the global tobacco epidemic. Country profile Thailand. Geneva: World Health Organization; 2019 (https://www.who.int/publications/i/item/9789241516204).
69. Tobacco Product Control Act. B.E. 2560 (2017). Nonthaburi: Department of Disease Control, Bureau of Tobacco Control; 2017 (http://www.ashthailand.or.th/en/content_attachment/attach/new_thai_law.pdf).
70. WHO report on the global tobacco epidemic 2021: Addressing new and emerging products. Geneva: World Health Organization; 2021 (https://www.who.int/teams/health-promotion/tobacco-control/global-tobacco-report-2021).
71. 85% of shops sell cigarettes to youngsters. Bangkok Post, 9 January 2020 (https://www.bangkokpost.com/thailand/general/1832034/85-of-shops-sell-cigarettes-to-youngsters).
72. Chaloupka FJ, Drope J, Siu E, Vulovic V, Stoklosa M, Mirza M et al. Cigarette tax scorecard. Tobacconomics. 2020 (https://tobacconomics.org/research/cigarette-tax-scorecard/).
73. Satitchaichareon S. Excise taxes Thailand. Presentation at the Seventh IMF-Japan High-level Tax Conference, 2016 (https://www.imf.org/external/np/seminars/eng/2016/asiatax/pdf/ss10.pdf).
74. The overall progress of tobacco tax policy implementation. Bangkok: SEATCA Tobacco Tax Program; 2021 (https://tobaccotax.seatca.org/country/thailand/).
75. Global tobacco index 2021: How deadly is tobacco industry influence in Thailand? Global Tobacco Industry Interference Index 2021. Pathumthani: Global Center for Good Governance in Tobacco Control; 2021 (https://reports.globaltobaccoindex.org/).
76. Tobacco tax cut aimed at farmers. Bangkok Post, 9 August 2019 (https://www.bangkokpost.com/business/1727491/tobacco-tax-cut-aimed-at-farmers).
77. Meeyai A, Yunibhand J, Punkrajang P, Pitayarangsarit S. An evaluation of usage patterns, effectiveness and cost of the national smoking cessation quitline in Thailand. Tob Control. 2014;24(5):10.1136 (10.1136/tobaccocontrol-2013-051520).
78. SHAKE the salt habit: the SHAKE technical package for salt reduction. Geneva: World Health Organization; 2016 (https://www.who.int/dietphysicalactivity/publications/shake-salt-habit/en/).
79. Healthy diet. Geneva: World Health Organization; 2020 (https://www.who.int/news-room/fact-sheets/detail/healthy-diet#:~:text=%20Key%20facts%20%201%20A%20healthy%20diet,less%20than%2010%25%20of%20total%20energy...%20More%20).

80. Limwattananon C, Jaratpatthararoj J, Thungthong J, Limwattananon P, Kitkhuandee A. Access to reperfusion therapy and mortality outcomes in patients with ST-segment elevation myocardial infarction under universal health coverage in Thailand. BMC Cardiovasc Disord. 2020;20:121 (https://doi.org/10.1186/s12872-020-01379-3).
81. Wang PS, Beck A, Berglund P, et al. (2003). Chronic Medical Conditions and Work Performance in the Health and Work Performance Questionnaire Calibration Surveys. Journal of Occupational and Environmental Medicine. 45, 1303–1311
82. Anesetti-Rothermel A, Sambamoorthi U (2011). Physical and mental illness burden: disability days among working adults. Population Health Management. 14(5):223–30. Erdal, et al., 2014,
83. Gordois, A, Toth, P, Quek, R, Proudfoot, E, Paoli, C, & Gandra, S (2016). Productivity losses associated with cardiovascular disease: a systematic review. Expert review of pharmacoeconomics & outcomes research, 16(6), 759-769.
84. Bommer C, Heesemann E, Sagalova V, et al. (2017). The global economic burden of diabetes in adults aged 20–79 years: a cost-of-illness study, Supplementary Appendix. The Lancet Diabetes & Endocrinology. 5, 423–430.
85. Thailand Burden of Diseases Attributable to Risk Factors, 2014. Nonthaburi: International Health Policy Program; 2018 (http://bodthai.net/en/download/thailand-burden-of-disease-attributable-to-risk-factors-2014/)
86. Institute for Health Metrics and Evaluation. 2021 'GBD Results Tool.' Global Health Data Exchange. Seattle WA: University of Washington. 16 November
87. WHO NCD Costing Tool. Geneva: World Health Organization, 2011. https://www.who.int/ncds/management/c_NCDs_costing_estimation_tool_user_manual.pdf?ua=1
88. Betram, M (Ed.) (2021) Special Issue on WHO-CHOICE Update [Special Issue]. International Health Journal of Health Policy and Management. 10: 670-733.
89. Bertram, M, Stenberg, K, Brindley, C et al. Disease control programme support costs: an update of WHO-CHOICE methodology, price databases and quantity assumptions. Cost Eff Resour Alloc. 2017; 15: 21. https://doi.org/10.1186/s12962-017-0083-6
90. Stenberg K, Lauer J, Gkountouras G, Fitzpatrick C, Stanciole A. Econometric estimation of WHO-CHOICE country-specific costs for inpatient and outpatient health service delivery. Cost Effectiveness and Resource Allocation. 2018 Dec;16(1):1-5.
91. Finance Minister orders Excise Department to launch tax measures to help labor. National News Bureau of Thailand, 7 July 2020 (http://thainews.prd.go.th/en/news/detail/TCATG200707124917819).
92. 2021 UN Food Systems Summit. 23 September 2021, New York City (NY). Winnipeg: International Institute for Sustainable Development; 2021 (sdg.iisd.org/events/2021-un-food-systems-summit/).
93. Attavanich, W., Sirbuaiam, K., Sirimongkonlertkun, N., Kajitvichyanukul, P., Saetang, P., Nasanit, R., Limsawart, W., and Pongpiachan, S., 2020. Clean Air Blue Paper: Insights on the Impact of Air Pollution and its Root Causes. 1st Edition. Thailand Clean Air Network, pp. 61-62.

7

Annexes

Annex 1. Primary demographic and economic data, with sources

Item	Value	Year	Source	Notes
Population (baseline year)	65 557 054	2020	National Statistical Office	
Population aged ≥ 15 years	83%	2020	National Statistical Office	
GDP	US$ 538 649 856 368	2019	Bank of Thailand	Current US$
GDP per capita	US$ 8215	2019	Calculation	
GDP per employed person (average productivity)	US$ 14 539	2019	Calculation	
Projected long-term GDP growth per year	5%	2021	World Bank	
Discount rate (for present value calculations)	3%		Analyst's choice	
Country income grouping	Upper–middle	2021	World Bank	
LCU name	Thai baht			
LCU alphabetical code	THB			ISO 4217
Exchange rate	31.11 LCUs per US$	April 2021	Bank of Thailand	
Labour force	37 705 520	2020	Bank of Thailand	≥ 15 years
Employed labour force	37 048 356	2020	Bank of Thailand	≥ 15 years
Unemployment rate (national)	1.6%	2020	Bank of Thailand	Employed labour force/labour force
Labour force participation rate	68.0%	2020	Bank of Thailand	≥ 15 years
Retirement age (years)	60	2020	Bank of Thailand	Public sector
Retirement age (years)	65	2020	Calculation	Average total retirement age[a]
Average number of days worked per year	237	2020	Labor Protection Act, Section 30	
Total health expenditure	618 949 000 000	2018 THB	WHO Global health expenditure database	Estimate
Government health expenditure	482 780 220 000	2018 THB	Assumption	
Government expenditure on NCDs	139 368 474 530	2018 THB	Calculation from report on health financing for NCDs, WHO Regional Office for South-East Asia SEARO and National Health Security Office	

Item	Value	Year	Source	Notes
Rate of labour force participation reduction				
Hypertension	1.5%	(1)		
Stroke	18%	(1)		
Acute myocardial infarction	11%	(1)		
Diabetes (< 40 years)	0.001%	(2)		
Diabetes (> 40 years)	10%	(2)		
Cancer	12.5%	(1)		
COPD and lung disease	8%	(1)		
Absenteeism: reduction in hours employed due to				
Hypertension	0.5%	(3)		
Stroke	9.0%	(4)		
Cardiovascular disease	9.0%	(4)		
Diabetes	1.7%	(2), adjusted by national expert opinion		
Cancer	5.1%	(3)		
COPD	2.7%	(5)		
Presenteeism: reduction in hours employed due to				
Cardiovascular disease, stroke	3.7%	(6)		
Diabetes	1.0%	(2)		
Cancer	5.2%	(6)		
COPD	11.6%	(6)		

a Public sector retirement age adjusted up to include private sector behaviour

COPD, chronic obstructive lung disease; GDP, gross domestic product; LCU, local currency unit

References

1. Barnay T, Debrand T. Effects of health on the labour force participation of older persons in Europe (Health Economics Letter No. 109). Paris: Institute for Research and Information in Health Economics. 2006.
2. Bommer C, Heesemann E, Sagalova V, Manne-Goehler J, Atun R, Bärnighausen T et al. The global economic burden of diabetes in adults aged 20–79 years: a cost-of-illness study. Supplementary appendix. Lancet Diabetes Endocrinol. 2017;5:423–30.
3. Anesetti-Rothermel A, Sambamoorthi U. Physical and mental illness burden: disability days among working adults. Pop Health Manage. 2011;14(5):223–30.
4. Gordois A, Toth P, Quek R, Proudfoot E, Paoli C, Gandra S. Productivity losses associated with cardiovascular disease: a systematic review. Exp Rev Pharmacoecon Outcomes Res. 2016;16(6):759–69.
5. Erdal M, Johannessen A, Askildsen J, Eagan T, Gulsvik A, Grønseth R. Productivity losses in COPD – A population-based survey. Eur Respir J. 2014;44(Suppl 58).
6. Wang PS, Beck A, Berglund P, Leutzinger JA, Pronk N, Richling D et al. Chronic medical conditions and work performance in the Health and Work Performance Questionnaire Calibration Surveys. J Occup Environ Med. 2003;45:1303–11.

Annex 2. Additional methodological considerations and limitations

Additional considerations and limitations to the methods described in the main report for estimating the current burden of disease, costing of scaling up services to address NCDs, modelling of their health impacts and valuation of the impacts as health benefits are discussed here.

Investment cases and analyses of economic burden consist of estimates of the economic value of health outcomes, as either current morbidity or mortality or modelled future averted morbidity and mortality. There are several ways to value, or monetize, health outcomes in economic terms. In this analysis, we used what is known as "the human capital approach", whereby the impact of death and disease is estimated on the stock of human capital, i.e., the workers who actively contribute to the economic activity of a country, the employed working age population. As the value of a year of employed life is best summed by a year's income, the human capital approach has been applied with data on average incomes in the formal and informal sectors to estimate a median yearly income for the entire working population. Given data constraints on the average income in the informal sector, we used a measure of GDP per employed individual as a proxy for average income. This is probably an overestimate, as factors such as income inequality make average values higher than medium values, and the components that enter into GDP, including asset appreciation, are not reflected in individual incomes.

Many investment cases and cost–benefit analyses have used a different approach to valuation, counting not only the impact of death and disability on human capital or the active workforce but on the entire population. An approach that values each life or each year of life equally estimates the "value of a statistical life", which represents a qualitative opinion of society's appreciation of human life. This approach, most often used in national surveys of individuals' willingness to pay to reduce the likelihood of death or disability, yields a construct of the price that people would pay to avert a premature death or regain a year of healthy life. We did not use this approach, for two reasons. Application of survey-based valuations from other, higher-income countries to Thailand would be unrepresentative and would conflate non market-based economic value with market-based economic value. The resulting economic benefits and return on investment ratio would therefore no longer represent the expected contributions to economic growth but a mix and valuations that do not represent the ethical importance held for the lives of others.

Although several input indicators used in the investment case could have been based on the most recent data, we used 2019 data for as many inputs as possible in order to avoid the temporary shock of the COVID-19 pandemic on the results, such as unemployment rate and indicators of risk factors. The pandemic will clearly affect the field of NCDs, as many people have changed their behaviour (principally for the worse) during the pandemic; however, the relative size of the problem and the costs of the benefits of addressing it should be similar to the results in either pre-pandemic or post-pandemic years.

A key input to estimation of both of the size of the economic burden and the economic benefits and return on investment of addressing NCDs is the number of years in a typical labourer's life. As noted in Annex 1, the retirement age in the formal public sector in Thailand is 60 for both males and females; however, a significant share of the population work outside the public sector and continue working far beyond their 60th birthday. As there is no uniform retirement age for this group but to attempt to include it, at least partially, in our analysis, we instead assume the average retirement age to be 65 and that therefore premature mortality or withdrawal from the labour force at the age of 60 represents 5 years of lost income.

To estimate the years of active labour lost to NCDs (or the benefits of averting the incidence or mortality of NCDs), we estimated the remaining average years of working life for each age cohort by combining the remaining years of labour with the probability of dying in each 5-year period, for which there is a specific projected mortality risk, as represented in the United Nations life tables for Thailand. There is, however, also a clear non-zero probability of withdrawing from the labour force due to factors unrelated to mortality. We included inability to participate in the labour force due to NCDs in our estimates but could not account for the impact of other diseases on unexpected early retirement. Similarly, we did not include in our model other exogenous economic factors, such as economic downturns, that may lead to long-term unemployment. As we did not take these conditions into account, we consider that the resulting years of working life either lost due to existing NCDs or regained due to scaling up interventions to be overestimates. Nevertheless, while we projected GDP (and average labour productivity) growth, we also kept constant the share of the employed labour force, including that in the formal sector of the economy. This will probably increase over time in middle-income countries, and the results are therefore underestimates of the resulting economic impact of keeping people in the labour force. Nevertheless, in view of general uncertainty about the economy and the labour market of Thailand in the future, there is little information on how best to change these assumptions to provide a more accurate representation of the expected economic benefits of avoided contractions in the labour supply in Thailand over the next 15 years.

Previous national NCD investment cases for estimating the health impact of scaling up clinical services for NCDs focused on CVD, COPD and diabetes. We also included breast, cervical and colorectal cancers in a package of interventions linked to each type of cancer, principally for screening and treatment. These have specific costs and expected health benefits in terms of premature mortality averted and improved health of individuals (averted DALYs), which contributed to the overall costs and economic benefits of the clinical package.

Use of the OneHealth Tool in estimating the health impacts of implementing and scaling up action related to the alcohol policy is a different approach from those for tobacco, physical activity and healthy diets. This tool can be used to estimate health impacts in two ways. One is through changes to the disease states of individuals in various age cohorts, as they progress through life, modelled in Spectrum, the modelling software package that creates a dynamic environment in which different factors change and impact each other over time. Here, changes to a risk factor would lead to decreases in the incidence of a disease or in the likelihood of

progressing to a worse disease state, eventually resulting in fewer deaths. A second channel, used only for alcohol in the OneHealth Tool, is a population-attributable-fraction approach, estimated outside of Spectrum. Here, the total fraction of a country's yearly deaths that are attributable to alcohol, including causes of death beyond COPD, CVD or diabetes, is adjusted down according to the impact of alcohol-reducing policies on hazardous alcohol use, yielding an additional set of avoided deaths and disability. This is seen among the non-economic benefits of the different policy packages for Thailand, as alcohol consumption is associated with a significant risk, and the intervention would result in a very high ratio of DALYs averted to deaths averted in this modelling approach. This is true only for alcohol policies, as the principal diseases affected by alcohol are not included in the OneHealth Tool.

Several of the parameters of the estimate of the impact of disease on inability to work, including absenteeism and presenteeism, are from research in high-income countries, where social safety nets and labour laws exist to cushion the blow of illness and support individuals in returning to work, more rapidly and overall. Application to the context of Thailand is not ideal, and further research would be helpful for making estimates that more accurately represent the realities of people with NCDs in middle-income countries who want to return to work.

In several parts of the investment case, complex methods and specific assumptions were used, which are not described in detail, either here or in the main report. Many are for parameters that could be adjusted to make the results more accurate for the local context, such as estimation of the impact of a certain intervention. Further work would help strengthen this aspect of the analysis, which could be taken into account in a subsequent investment case. Furthermore, while air pollution was analysed as a risk factor in estimating the economic burden of NCD risk factors, interventions to address this factor were not included in the investment case analysis. Research to identify and contextualize the resources required and expected impact of a set of interventions to address air pollution would strengthen this analysis, possibly in the form of a stand-alone investment case for air pollution.

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Noncommunicable diseases (NCDs) such as cancer, cardiovascular diseases, diabetes and chronic obstructive pulmonary disease (COPD) are the number one killer in Thailand, responsible for 74% of all deaths. The premature death, morbidity and disability associated with NCDs are more than a health issue – they negatively affect socio-economic development and long-term fiscal sustainability. This report provides evidence through three analyses that NCDs reduce economic output and discusses potential options in response, outlining details of their relative returns on investment.

An economic burden analysis shows that NCDs cost the Thai economy THB 1.6 trillion annually, equivalent to 9.7% of its 2019 gross domestic product (GDP).

An intervention costing analysis provides an estimate of the funding required to implement a set of policy interventions for prevention and selected clinical interventions. A cost–benefit analysis compares these implementation costs with the estimated health gains and identifies which intervention packages would give the greatest returns on investment. The findings show that investment in the suggested evidence-based policy and clinical interventions would save 310 000 lives and generate THB 430 billion in benefits for the national economy in the next 15 years.

The report concludes with recommendations for actionable steps that the Government can take to strengthen a whole-of-government, whole-of-society approach to NCDs and their consequences.