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## Public health in Thailand: emerging focus on non-communicable diseases

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### SUMMARY

Over the past three decades, the public health landscape in Thailand has shifted remarkably. Currently chronic non-communicable diseases represent the largest cause of mortality in the Thai population. In light of the current situation, this paper synthesizes what is known about the chronic non-communicable disease situation in Thailand and analyzes current policy responses. Relevant contextual factors such as socio-economic transitions, health systems development, and health workforce capacities are also considered. Primary data for this study were collected by a review of policy documents, government statements, and statistics reported by the Thailand Ministry of Public Health. Secondary data were obtained by a thorough review of the existing literature. The paper finds that while current policy responses to chronic non-communicable diseases in the health sector have focused on improving prevention and control of risk factors, a stronger emphasis on chronic disease treatment and management may be needed in the future. The paper concludes with an exploration of the potential for developing and implementing realistic public health responses to the growing burden of chronic non-communicable diseases in a Southeast Asian country context by utilizing existing capacities in research, policy, and health workforce development.

### Keywords

Thailand; public health; cancer; cardiovascular disease; health policy

### INTRODUCTION

Over the past three decades, the public health landscape in Thailand has shifted remarkably, as previously significant health concerns have been successfully addressed while new and re-emerging health problems have appeared. These shifts accompany changes in Thai society related to the dynamics of globalization and rapid economic growth, as well as the development of the Thai health care system.

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with epidemiological transition and particularly with risk factors for cardiovascular diseases (Yusef *et al.*, 2001).

### Development of the Thai health care system

Thailand's economic growth has enabled significant investment in its health care system. The Ministry of Public Health (MoPH) budget increased from 986.6 million baht in 1972 to 129.7 billion baht in 2007, with the most significant recent achievement being the establishment of a universal health care coverage policy in 2002 (Universal Coverage). As a proportion of GDP, total health expenditures in 2001 amounted to 3.2%, and it is estimated that total national health expenditures will increase to 3.64% of GDP by 2010 and 3.88% of GDP by 2020 (Patcharanarumol *et al.*, 2006). This compares with health expenditures as a proportion of GDP of 10.7% in Canada in 2008 (Canadian Institute for Health Information, 2008), and expenditures of 8.8% in Australia, 3.7% in Singapore, 3.8% in Malaysia, and 3.4% in the Philippines in 2005 (Australian Institute of Health and Welfare, 2005). As a proportion of the national budget, the MoPH budget increased from 4.8% in 1990 to 8.3% in 2007 (Thailand Health Profile 2005–2007, 2008).

Improvements in healthcare financing have led to significant health systems development in Thailand. For example, medical equipment and health personnel have been distributed to rural health centers, (Putthasri *et al.*, 2004) and quality assurance systems and drug procurement protocols established (Pongpirul, 2002). Yet significant regional discrepancies persist; for example a recent study of access to mammogram machines found for every one million females over 35 years old, 41.8 mammogram facilities were available in Bangkok, but only 2.8 facilities were available in the North and 4.0 in the Northeast (Putthasri *et al.*, 2004). There have also been significant efforts to improve and expand the health workforce through recruitment and retention support. For example, the Praboromarajchanok Institute of Health Workforce Development has been responsible for the production of health personnel to fulfill MoPH needs since 1993, and currently operates 38 colleges across Thailand (Wongkongkathep *et al.*, 2004; Praboromarajchanok Institute, 2007).

Thailand's system for the production and development of public health personnel has historically faced challenges in three areas: (1) policy and operation coordination with broader public health strategies at the national level; (2) building up equity in the availability of care and (3) reducing the problem of medical 'brain-drain' and personnel shortages in rural areas (Thailand Health Profile 2005–2007, 2008). The development of a professional nursing workforce, distributed throughout the country to the MoPH's lowest administrative unit (the sub-district or *tambon* of 10 000 people) has been a particularly important component of efforts to overcome these challenges. There are currently 74 colleges/institutions in Thailand producing professional nurses, including 64 public and 10 private institutions (Thailand Health Profile 2005–2007, 2008). Of the Praboromarajchanok Institute for Health Workforce Development's 38 colleges, 29 are nursing colleges located in different geographic regions across Thailand (Praboromarajchanok Institute, 2007).

## Chronic disease trends in the Asia-Pacific region

Chronic non-communicable diseases such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes are by far the most significant causes of mortality in the world, and 80% of chronic disease deaths occur in low and middle income countries (WHO, 2009b). In recent decades cardiovascular diseases have emerged as a leading cause of death in Asia, and across the South-East Asian region in particular (Asia Pacific Cohort Studies Collaboration, 2007). This may be linked to changing lifestyles and urbanization accompanying rapid economic development in some parts of the region as well as increase in life expectancy. Significant changes in diet, particularly increased consumption of fat and sugar, along with reductions in physical activity have occurred in many Asian countries (Popkin, 2001). High cholesterol is a known risk factor for many chronic diseases, yet awareness about the importance of raised cholesterol is relatively low among health care professionals, policy makers, and the general public in many Asian countries (WHO, 2002).

About half of the world's cardiovascular disease cases now occur in the Asia-Pacific region. Smoking and increased levels of blood pressure are known to substantially increase the risk of cardiovascular diseases in Asian populations (Nakamura *et al.*, 2008). The WHO predicts nearly half of the 89 million NCD-related deaths projected for the South East Asian region over the next 10 years will occur prematurely, negatively impacting the social and economic development status of countries in the region (WHO, 2009c). Yet despite expectations that Asian countries will be among those countries experiencing the greatest increases in cardiovascular diseases over the next few decades, high-quality country-specific information about emerging epidemiological trends in NCDs remain low, and national research infrastructures are limited (InterASIA Collaborative Group, 2003).

## METHODS

Primary data for this study derived from a review of MoPH policy documents, annual reports, and interpretation of Thailand government statistics. Information was collected from several MoPH departments, including the Bureau of Non-Communicable Diseases, the Bureau of Policy and Strategy, and the Praboromarajchanok Institute for Health Workforce Development. Policy and planning documents were translated from the Thai by the research team. Information was also gathered from interviews conducted with senior health officials in the Ministry of Public Health. A thorough review of existing academic literature was undertaken to capture the major public health challenges facing Thailand. Initial findings were integrated back into the investigation, and were used to guide further exploration and analysis of key issues as they emerged. The study methodology faced some limitations derived from the fragmented nature of nationally representative public health data in Thailand.

## RESULTS

### Chronic disease trends in Thailand

Cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes are among the most significant emerging health concerns in Thailand, yet are often not detected until

they have progressed to an advanced level. Nation-wide surveillance data on NCDs remain unreliable, though the MoPH has reported hospitalization data on morbidity (excluding Bangkok) from NCDs steadily rising from 1032 per 100 000 population in 2001, to 1674 per 100 000 population in 2004 (Bureau of Policy and Strategy, 2009b). As a result of excluding Bangkok, the largest urban area, these figures likely understate the true morbidity rate. In 2003, the InterAsia Collaborative Group reported all major risk factors for chronic diseases, except smoking, are higher in urban compared with rural areas in Thailand (InterASIA Collaborative Group, 2003).

A comparison of mortality statistics reported by the Bureau of Policy and Strategy between the years 1977 and 2008 (Bureau of Policy and Strategy Website, 2009a) illustrates the significant shifts in leading causes of death in recent years (see Table 1). We found reported death rates from non-communicable diseases have increased dramatically. While this increase could partly result from improvements in the quality of data collection and reporting on death rates and causes, this nonetheless suggests an increase in trend in a range of chronic non-communicable diseases.

This trend is well supported by data from other epidemiological studies. The 2006 Health and Welfare Survey of the Population and Social Statistics Group, Thailand National Statistics Office, reports 16% of the total population of Thailand has some form of chronic disease, with an average reported level of 35.6% among those over 45 years of age (Economic and Social Statistics Bureau, 2006). While this number reflects all chronic diseases, cardiovascular diseases accounted for 27.7% of those reported, and respiratory system diseases accounted for 8.9%. A cohort study of employees of the Electricity Generating Authority of Thailand (EGAT) from 1985 to 1997 found several risk factors determine the chances of developing a non-communicable chronic disease in Thailand, including age, sex, body mass index, waistline, hypertension, family history of diabetes, impaired glucose tolerance, triglyceride level, and HDL-cholesterol level. Importantly, the study found that some of the risk factors for developing chronic diseases in the Thai population can be controlled or modified (Sritara *et al.*, 2003).

### Cardiovascular diseases

In 2002, cardiovascular diseases were the single largest contributor to mortality in Thailand, estimated by the WHO to represent 20% of all death (WHO, 2009a). The WHO projects the prevalence of overweight individuals in Thailand to increase in males and females aged 30 years and over from 34% to 35%, and from 47% to 57%, respectively, during the period 2005–2015 (WHO, 2009a). Obesity, defined by raised body mass index, is well known to be associated with increased incidence of cardiovascular diseases, type 2 diabetes, hypertension, stroke, dyslipidemia, osteoarthritis, and some types of cancers (Must *et al.*, 1999).

Several large studies document the growing importance of cardiovascular diseases in Thailand. The Asia Pacific Cohort Study investigated the relationship between high total cholesterol (TC), defined as  $\geq 6.2$  mmol/l, and the proportion of attributable fatal coronary heart disease and ischemic events that, theoretically, could be avoided if high TC were to be eliminated in 16 Asia-Pacific countries. They reported a population attributable fraction of

34% and 35% for males and females, respectively, in Thailand, higher than the Philippines (7%, 12%), Malaysia (21%, 20%), China (28%, 26%), and Taiwan (32%, 26%), but lower than Singapore (37%, 31%), Japan (36%, 34%), Australia (46%, 41%), and New Zealand. (47%, 42%) (Woodward *et al.*, 2008). A study of cardiovascular risk levels in urban and rural Thailand involving a structured questionnaire, brief physical examination and a blood sample from 5305 participants aged 35 years and older found absolute levels of risk factors to be high, with all major risk factors except smoking worse in urban rather than rural areas (InterASIA Collaborative Group, 2003). This study, conducted with data collected in 2000, estimated the following population prevalence of major risk factors in individuals aged 35 years and older (see Table 2). Chronic obstructive pulmonary disease is projected to trend steadily upwards, with estimates per 100 000 population rising from 2268 in 2001 to 7035 in 2010 (Thailand Public Health Profile 2001–2004, 2005).

In 2006, the MoPH Bureau of Epidemiology reported 792 035 cases of hypertension, of which the majority were female, 501 625, while 290 428 were male (Annual Epidemiological Surveillance Report, 2006). In the same year 83 047 cases of ischemic heart disease were reported, with 40 531 male patients and 42 516 female patients (Annual Epidemiological Surveillance Report, 2006). Comparing this with subsequent data from the 2007 Annual Epidemiological Surveillance Report suggests an upward trend in each disease, with 1 047 154 cases of hypertension (389 834 male, 657 319 female); and 121 729 cases of ischemic heart disease (58 079 male, 63 650 female) occurring in Thailand (Annual Epidemiological Surveillance Report, 2007).

## Cancer

Cancer is a significant concern in Thailand, representing 14% of all deaths in 2002. There is a troubling trend as the hospital admission rate for cancer per 100 000 population has increased from 34.7 in 1994 to 124.4 in 2006 (Thailand Health Profile 2005–2007, 2008). In comparison with other countries with developed health care systems such as the US, the level of screening and early diagnosis in Thailand is low. For example, a 2004 health examination survey of females aged 15–59 found just 49% of respondents had ever been screened for cervical cancer, 23–24% had ever received a breast examination from a health care professional, and 4% had ever received a mammogram (Thailand Health Profile 2005–2007, 2008). According to the National Cancer Institute, the highest rate of breast cancer has been found in the Bangkok Metropolitan area, and the Thanyarak Breast Cancer Treatment Center at Siriraj Hospital, one of the largest teaching hospitals in Thailand, reported 80% of Thai female breast cancer patients were at invasive stages of progression (Thailand Health Profile 2005–2007, 2008). Of the Thanyarak Center's 5994 patients between 1995 and 2004, 2487 or 41.5% were between the ages of 40 and 49 (Thailand Health Profile 2005–2007, 2008). Most recent data from 2008 show of 795 new breast cancer patients, 422 (53.1%) were between the ages 40 and 55 (National Cancer Institute, 2009). This contrasts with data from the American Cancer Society (2006), which report the largest proportion of US breast cancer patients are females aged 70–79 (24.2% of all patients), while just 5.1% of patients were less than 40 years of age. A recent cohort study of breast cancer risk factors in Thailand suggest substantial increases in breast cancer rates in Thailand could be expected in the future (Jordan *et al.*, 2009).

Liver cancer is a significant concern in Thailand, with Vatanasapt and Sriamporn (1999) reporting that Khon Kaen province, Thailand, has the highest incidence of liver cancer in the world in females (32.7 per 100 000 population), and an extremely high incidence rate in males (85.0 per 100 000). Overall the national incidence rate of liver cancer per 100 000 population was 31.2 in males and 11.5 in females in 2000. Most recent data from the National Cancer Institute of Thailand (2009) report the most common cancers in 2008 in males were: colon and rectum (17.4%), bronchus and lung (16.2%), liver and bile duct (10.5%), oral cavity (8.5%), esophagus (5.1%), nasopharynx (4.4%), and non-Hodgkin lymphoma (4.1%). In women, most common cancers in 2008 were breast (43%), cervix and uteri (16.4%), colon and rectum (8.8%), bronchus and lung (5.2%), liver and bile duct (3.3%), corpus uteri (3.1%), and oral cavity (2.9%).

### HIV/AIDS-related cancer

The Bureau of AIDS, TB and STIs at the Thailand MoPH (2008) provide updated estimates for the Asian Epidemic Model (AEM) Projections for HIV/AIDS in Thailand 2005–2025, estimating that in 2008 there are 1 115 000 persons who have been infected with HIV/AIDS since the start of the epidemic, of which 532 500 people are still alive and currently living with HIV. People with immune deficiency from HIV have been found to be at increased risk of numerous cancer types. However, in the Thai context little is known about the relative risk cancer in HIV-positive people. Much of the limited research on HIV/AIDS related cancer has used large clinical cohorts located in North American or European settings, and very little is known about the situation for HIV/AIDS patients in low and middle income country settings where highly active antiretroviral therapy (HAART) have been widely rolled out in recent years.

A 1998 US study of data from 98 336 people with AIDS and 1 125 098 people with cancer found AIDS patients have increased risk of numerous types of cancer compared with the general population, including lip, oropharyngeal, laryngeal, stomach, liver, Hodgkin's disease, lymphoid leukemia, multiple myeloma, seminoma, anal, melanoma, non-melanoma skin, and lung cancers (Goedert *et al.*, 1998). A recent meta-analysis by Grulich *et al.* (2007) compared large population-based cohort studies of people with HIV/AIDS and people immunosuppressed after solid organ transplantation to determine whether a wider range of cancers is associated with immune-deficient status. Their findings indicate immune deficiency is responsible for increased risk of cancer, and suggests infection-related cancer will become an increasingly important complication of long-term HIV infection. This has potentially important implications for people on HAART in Thailand, and suggests detection and treatment of cancers could become an increasingly important component of the HIV care landscape. However, the resources available for prevention, diagnosis and treatment of cancers in Thailand remain limited, and interactions between available ART regimens, differing social, behavioral, and environmental risk factors, and the profile of cancers of HIV patients remain poorly understood. Moreover, there are significant gaps in knowledge about HIV-related cancers to be filled with research done in the Thai context.

## Obesity and diabetes

Obesity and overweight are known to be major risk factors for chronic diseases including type 2 diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer globally (WHO, 2003a). A 2002 study of transitions in nutrition and dietary patterns in Thailand found strong evidence of increasing trends in obesity and overweight over the past three decades (Kosulwat, 2002). Obesity and overweight were found to be a major risk factor for coronary heart disease in a cohort study of 2536 male employees of the Electricity Generating Authority of Thailand at 17 years follow-up (Aekplakorn *et al.*, 2007). Upward trends in obesity rates among Thai children have been described with concern by the International Health Policy Program of the MoPH (Pulkerd, 2007), as well as by the WHO which noted the prevalence of obesity in 5–12-year old children in Thailand rose from 12.2% to 15–6% in just 2 years (WHO, 2003b). In 2006, the Bureau of Epidemiology identified 609 654 cases of diabetes in the Thai population, of which 201 699 were male while 407 955 were female (Annual Epidemiological Surveillance Report, 2006). The following year 714 892 diabetes cases (229 715 male, 485 177 female) were reported, representing an increase of 17.26% (Annual Epidemiological Surveillance Report, 2007). While the increase in total number of diagnosed cases of diabetes may be related to advances in screening and diagnostic capabilities and access to medical care, the upward trend is likely also related to nutrition.

## Kidney disease

Chronic kidney disease is a significant concern in Thailand (Narenpitak and Narenpitak, 2008) with 12 884 deaths and a death rate of 20.6 per 100 000 persons occurring from nephritis, nephrotic syndrome and nephrosis in 2006 (Annual Epidemiological Surveillance Report, 2006). A recent study of the prevalence of stage III and IV chronic kidney disease in Thailand was conducted in 2008 using a stratified, multistage, cluster-sampling method of individuals aged 35 and above from the Thai 2000 Census (Perkovic *et al.*, 2008). The study found the prevalence of stage III kidney disease to be about 20% using a Cockcroft–Gault formula and about 13% using a simplified Modification of Diet in Renal Disease formula. Using these respective formulas, the study found prevalence of stage IV kidney disease to be about 0.9% and 0.6% of this population. The prevalence of both stage III and IV chronic kidney disease was significantly higher than reported in individuals over 40 years old from the United States, and also higher than the reported incidence in Taiwan and Australia (Narenpitak and Narenpitak, 2008).

## Thailand's response to chronic non-communicable diseases

The Thai health care authorities have recognized the burden of NCDs, and the MoPH is working to address this problem. The Bureau of Non-communicable Diseases, in the Department of Disease Control, MoPH, has primary responsibility for NCD prevention and control in Thailand. The Bureau was established in 2003; previously NCDs had been addressed through Thailand's National Health Development Plan (2002–2004). Over the past 10 years, the MoPH has undertaken a series of cross-cutting programs to address major risk factors, including a Comprehensive Tobacco Control Program, Comprehensive Alcohol Control Program, several nutrition related programs (Clean Food Good Taste, dietary



guidelines and education, healthy recipes, nutritional labeling for NCD risk reduction, 'Children Not to Eat Sweet' network), and interventions promoting physical activity (Empowerment for Health, Exercise for Health) (Supornsilaphachai, 2005). Additional areas in which NCD risk prevention and control activities have been pursued include:

- cervix screening and self breast examination promotion,
- cardiovascular diseases, hypertension and diabetes awareness programs,
- quality improvement for hypertension and diabetes screening,
- health promotion in schools since 1999,
- Jump Rope Project initiated by Thai Heart Foundation,
- Healthy Work Place program since 2000,
- Health Promoting Hospital since 2000,
- Healthy Cities initiative since 1999.

In Thailand, the current guiding document which serves as a position statement for national NCD priorities is the Bureau of NCDs Strategic Planning Framework 2008–2011 (Bureau of Non-Communicable Diseases, 2008). This framework outlines seven principles that are intended to direct the national policy and programming activities of the Bureau. These are: (1) innovation in responding to NCDs; (2) human resources development; (3) establishing national policies and activities to support local-level NCD prevention, surveillance, and control; (4) developing surveillance systems and reliable data collection and management; (5) strengthening networks among hospitals and health care workers; (6) changing attitudes, values, and organizational culture within the health care system; (7) developing resource management and monitoring and evaluation capacities (Bureau of Non-Communicable Diseases, 2008).

To coordinate NCD prevention and control activities at the national level the MoPH has also established the Partnerships for Prevention and Control of NCDs Working Group (Bureau of Non-Communicable Diseases, 2009). This working group is intended to link the Bureau of Non-Communicable Diseases with the other relevant departments throughout the MoPH, including the Department of Health (responsible for family health and health promotion), the Department of Health Services Support, the Department of Thai Traditional Medicine, the Department of Mental Health, the Bureau of Policy and Planning, the Food and Drug Administration, and the National Health Security Office. The working group objectives are to achieve broad behavior changes in the general population and high-risk groups, and improved social, environmental, health, and economic status, leading to healthier Thai citizens. The working group is currently implementing six action plans: (1) surveillance and screening of high risk groups for diabetes at both community hospitals and using local health volunteers; (2) awareness and education about NCDs and a national behavior change campaign; (3) improving environmental conditions and risk reduction in communities; (4) counseling and behavior change in high risk groups and NCD patients; (5) capacity building for health workers in NCD prevention, and health systems strengthening; (6) monitoring and evaluation of all activities (Bureau of Non-Communicable Diseases, 2009). An important

feature of this working group is its mandate to promote NCD responses that are geared to Thai cultural and traditional contexts, including prevention of chronic diseases at the family and community level. For example, the project 'Health with Thai Lifestyle' is an innovative health promotion project led by the Bureau of NCDS that engages community health volunteers to act as role models for healthy living within Thai lifestyles, and to provide advice promoting healthy living in communities throughout Thailand.

The development of existing national policy and programming frameworks for NCD prevention and control in Thailand have been guided by a comprehensive SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis of the NCD situation and relevant MoPH capabilities, conducted by the Department of Disease Control (Bureau of Non-Communicable Diseases, 2008). This analysis found key strengths include: the existence of capable staff and competent healthcare workers throughout Thailand, the presence of academic experts connected nationally and internationally, effective senior level management, strong policy development processes at the national level, and the experience of having successfully implemented the a Comprehensive Tobacco Control Program. Weaknesses include: unorganized local and mid-level management, staff shortages and high workloads in rural areas, little time or opportunity for continuing training, weak resource management, and unclear treatment guidelines for some NCDs. Key opportunities were seen to include a strong national policy response to NCDs, capable networks of health care workers and hospitals, a Department of Disease Control administrative center located in every region of Thailand, budget support from both public and private sectors, and support from academics and research. Main threats were identified as the negative influence of the media and advertising leading to changes in lifestyles and increasing risks for NCDs, inconsistent and unreliable information about NCDs are being distributed to the public, low public awareness of NCD issues especially among less well educated people, and high healthcare worker turnover in rural areas (Bureau of Non-Communicable Diseases, 2008).

## DISCUSSION

In light of the emerging focus on chronic non-communicable diseases in Thailand's public health landscape, the need for national health policies and systems to be in step with population needs is critical. The increasing pressure that NCDs are placing on the Thai health care system is clearly illustrated by the increase in hospitalization rates between 1985 and 2006. Between 1985 and 2006, the rate of hospitalization of patients per 100 000 population for heart diseases grew from 63.4 to 618.5, for cancer from 53.8 to 124.4, and for diabetes from 33.3 to 586.8 (Thailand Health Profile 2005–2007, 2008). Yet it is clear from current policy frameworks that the Thai health authorities' current approach towards NCDs prioritizes population level prevention, behavior change, and control, while considerably less emphasis is placed on expanding treatment and chronic disease management capacities within the health care system.

The importance of strong prevention programs is well supported by evidence from studies conducted in Europe and North America, which indicate that significant reductions in mortality from NCDs can be achieved with relatively simple public health interventions targeting modifiable risk factors such as blood pressure, blood cholesterol, smoking, obesity,

and their socio-economic determinants at population, community and individual levels (Darnton-Hill *et al.*, 2004; Nishida *et al.*, 2004). Yet as more lives are prolonged or saved/spared from communicable diseases, there will be chronic conditions whose onset will be prolonged but not totally prevented, as trends in Western countries indicate (Cooper *et al.*, 2000; Edward *et al.*, 2005). Moreover, rapid upward trends in numerous risk factors portend far more substantial chronic disease treatment needs may be looming on the horizon for the Thai health care system. Given these factors, Thailand needs to ensure its health care system is prepared to meet the emerging and future challenges that NCDs will pose. Expanding NCD planning and policy frameworks to include a stronger focus on treatment and chronic disease management is recommended.

Public health policies in Thailand should focus on achieving appropriate selection and use of chronic care and treatments within the health system, affordable and sustainable chronic care management within the existing public health insurance schemes, and a health workforce sufficiently trained in managing chronic conditions and rationally distributed throughout all geographic regions. These are essential to ensuring equitable access to care and treatment, particularly in poorer and geographically remote regions in Thailand.

Positioning the Thai health care system to meet steadily increasing chronic care demands is a resource allocation decision, with significant implications for the way care is provided to people with chronic diseases. Thailand's current health financing cannot support a dramatic expansion of high-cost clinical procedures under Universal Coverage, so realistic approaches are needed that maximize Thailand's existing strengths and health services capacities. Thailand has achieved affordable and accessible care for certain types of patients requiring long-term care, for example AIDS patients, through a system of distributing stable patients from larger provincial hospitals back to more local community hospitals and primary care centers. This has required building AIDS care and management capacities throughout all levels of hospitals, and particularly within Thailand's professional nursing workforce. Similar efforts with Thailand's nursing workforce could provide added support for decentralized NCD care, and improve NCD treatment and management capacities at community hospitals and more local primary care treatment centers. Additional capacity building for community hospitals and health workforces could focus on areas such as chronic disease treatment and chronic care management, streamlined patient data storage and management, drug procurement and storage systems, and financial reporting and budgeting support.

The human resource needs for chronic care management are different from the human resource needs for prevention-based interventions, and will require adapting the human resource development strategy of the MoPH. Thailand's impressive professional nursing workforce, already well established with a ratio of nurse/population of 1/619 in 2006, is distributed throughout all levels of the health care system in all geographic regions (Health Information Unit, Bureau of Policy and Strategy, 2006) and may be crucial to meeting the future chronic treatment needs of the Thai population. For example, Potempa *et al.* (2009) have shown that efforts to leverage capacities in nursing to provide care for HIV patients are possible and successful in the Thai context.

A stronger focus on strengthening the research capacities of the MoPH may also be needed to achieve the Bureau of NCDs stated policy directives of innovation in NCD responses, and improved surveillance and data management. For example, research on chronic disease management in the Thai context could potentially identify and promote ways of providing chronic care and treatment that are better geared to Thai cultural and community realities and socio-economic contexts.

## CONCLUSION

This review of the state of chronic disease in Thailand is timely, and underscores the shifting trends in mortality currently under way. Cost effective interventions to prevent and treat emerging chronic diseases exist, and have worked in many other countries. Based on the trends described in this paper, we conclude similar interventions could work in Thailand, and are needed. Successful strategies elsewhere have involved multi-layered initiatives combining population-based approaches with interventions targeting individual behavior change/modification as well as chronic treatment management. This review indicates additional research is needed to better understand the epidemiology of non-communicable chronic diseases in Thailand, as well as to guide the development and implementation of interventions to improve treatment and management of chronic disease patients. Multi-sectoral efforts are necessary spanning concerted policy actions and legislative shifts, as well as interventions involving a diversity of delivery channels beyond just the MoPH, such as other relevant ministries, public opinion leaders, politicians, legislative bodies, and policy makers in various education and law enforcement systems.

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Number of deaths and death rate per 100 000 population by leading causes of death, 1977 versus 2008

Table 1.

		1977				2008			
Rank	Causes of death	Number	Rate	Rank	Causes of death	Number	Rate	Rank	Rate
Total	All causes	236 854	545.2	Total	All causes	391 127	624.6		
1	Diseases of the respiratory system	25 033	57.7	1	Malignant neoplasm, all forms	55 403	87.6		
2	Accidents and poisoning	15 181	31.1	2	External causes, including accidents and poisonings	41 786	66.1		
3	Diseases of the digestive system	11 095	25.5	3	Infectious and parasitic diseases	38 672	61.2		
4	suicide, homicide and other injury	11 067	25.5	4	Diseases of the heart and circulatory system	35 391	56.0		
5	Malignant neoplasm, all forms	8180	19.4	5	Diseases of the respiratory system	26 358	41.7		
6	Tuberculosis	7041	16.2	6	Diseases of the genitourinary system	14 896	23.6		
7	Diseases of the heart and circulatory system	6610	15.2	7	Diseases of the digestive system	13 053	20.6		
8	Intestinal Infectious diseases	6455	14.9	8	Endocrine, nutritional and metabolic diseases	8601	13.6		
9	Diseases of the nervous system	4774	11	9	Disease of the nervous system	5093	8.1		
10	Rickettsiosis and other arthropodal diseases	4771	11	10	Diseases of the blood and blood-forming organs	563	0.9		



**Table 2.**

## Major risk factors in Thailand

<b>Risk factor</b>	<b>Prevalence in Thai Males 35 years</b>	<b>Prevalence in Thai Females 35 years</b>	<b>Total 35 years</b>
High blood pressure	21%	20%	21%
High cholesterol	14%	21%	18%
Diabetes	9%	10%	9.6%
Overweight	28%	43%	36%
Current cigarette smoker	48%	3%	25%

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