MORBIDITY EXPANSION AMONG THAI POPULATION

Ms. Araya Prasertchai

A Dissertation Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy Program in Research for Health Development
(Interdisciplinary Program)
Graduate School
Chulalongkorn University
Academic year 2008

การขยายตัวของภาวะการเจ็บป่วยในประชากรไทย

นางสาว อารยา ประเสริฐชัย

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต
สาขาวิชาวิจัยเพื่อการพัฒนาสุขภาพ (สหสาขาวิชา)
บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2551

Thesis Title	MORBIDITY EXPANSION AMONG THAI POPULATION
By	Ms. Araya Prasertchai
Field of Study	Research for Health Development
Advisor	Professor Sutthichai Jitapunkul, M.D.
Co-advisor	Assistant Professor Wichai Aekplakorn, M.D., Ph.D.
Co-advisor	Vipat Kuruchittham, Ph.D.

Accepted by the Graduate School, Chulalongkorn University in Partial Fulfillment of the Requirements for the Doctoral Degree

……………………………………………….. Dean of the Graduate School
(Associate Professor Pornpote Piumsomboon, Ph.D.)

THESIS COMMITTEE

… ..…………………………………………….. Chairman
(Assistant Professor Ratana Somrongthong, Ph.D.)

...…………………………………………..……. Advisor
(Professor Sutthichai Jitapunkul, M.D.)

. ……………………………………………….. Co-Advisor
(Associate Professor Wichai Aekplakorn, M.D., Ph.D.)

..……………………………………………….. Co-Advisor
(Vipat Kuruchittham, Ph.D.)

………………………………………………….. Examiner
(Associate Professor Vipan Prajuabmoh, Ph.D.)

………………………………………………….. Examiner
(Prathurng Hongsranagon, Ph.D.)

………………………………………………….. External Examiner
(Somsak Chunharas, M.D.)

อารยา ประเสริฐชัย: การขยายตัวของภาวการเจ็บป่วยในประชากรไทย (MORBIDITY EXPANSION AMONG THAI POPULATION). อ. ที่ปรึกษาวิทยานิพนธ์หลัก: ศ. นพ. สุทธิชัย จิตะพันธ์กุล อ. ที่ปรึกษาวิทยานิพนธ์ร่วม: รศ. ดร.นพ.วิชัย เอกพลากร, ดร. วิพัฒน์ คุรุจิตธรรม, 195 หน้า.

อายุคาดหมายเฉลี่ยของประชากรทั้งหญิงและชายในประเทศไทยมีแนวโน้มเพิ่มขึ้นซึ่งเป็นผลเนื่องมาจากอัตราการเกิดและอัตราการตายลดลง รวมทั้งอายุคาดหมายเฉลี่ยของประชากรสูงอายุก็มีแนวโน้มเพิ่มสูงขึ้นอย่างเห็นได้ชัด การมีอายุยืนยาวขึ้นนั้นอาจจะไปด้วยสัดส่วนของการมีสุขภาพดี หรือมีการเจ็บป่วย หรือมีภาวะทุพพลภาพ วัตถุประสงค์ของการศึกษานี้ เพื่อศึกษาแนวโน้ม 4 ประเภท 1. แนวโน้มภาวการเจ็บป่วยตามกลุ่มอายุด้วยโรคเรื้อรัง (ความดันโลหิตสูง เบาหวาน) และ ดัชนีวัดสุขภาพ (ระดับน้ำตาลในเลือด ระดับไขมันในหลอดเลือด และดัชนีมวลกาย) 2. แนวโน้มของภาวะทุพลภาพตามกลุ่มอายุ 3. แนวโน้มการตายตามกลุ่มอายุด้วยโรคเรื้อรังของโรคหัวใจขาดเลือด โรคหลอดเลือดสมองและมะเร็ง 4. แนวโน้มของสัดส่วนของ อายุคาดหมายเฉลี่ยที่มีสุขภาพดีต่ออายุคาดหมายเฉลี่ยที่อายุ 60 ปีขึ้นไป

การศึกษาในครั้งนี้เป็นการศึกษาภาคตัดขวาง โดยใช้ข้อมูลทุติยภูมิ ที่ประกอบไปด้วย ข้อมูลภาวะการเจ็บป่วย ข้อมูลภาวะทุพพลภาพ ข้อมูลการตาย ข้อมูลภาวะการเจ็บป่วยได้มาจาก การสำรวจสภาวะสุขภาพอนามัยของประชาชนไทย ด้วยการสอบถามและตรวจร่างกายทั่วประเทศ ข้อมูลการตายได้มาจากสถิติสาธารณสุขแห่งชาติรายปี ข้อมูลภาวะทุพพลภาพได้มาจาก การสำรวจประชากรผู้สูงอายุในประเทศไทย และอายุคาดเฉลี่ยของภาวะสุขภาพดีได้มาจากการคำนวณโดยใช้วิธีของซัลลิแวน

ผลการศึกษาพบว่า 1. แนวโน้มภาวการณ์เจ็บป่วยตามกลุ่มอายุด้วยโรคเรื้อรัง และดัชนีวัดสุขภาพ เพิ่มขึ้น 2. แนวโน้มของภาวะทุพลภาพตามกลุ่มอายุ เพิ่มขึ้น 3. แนวโน้มการตายตามกลุ่มอายุด้วยโรคเรื้อรัง เพิ่มขึ้น 4. แนวโน้มของสัดส่วนของ อายุคาดหมายเฉลี่ยที่มีสุขภาพดีต่ออายุคาดหมายเฉลี่ยที่อายุ 60 ปีขึ้นไป ลดลง สรุปคือ สถานะสุขภาพของประชากรไทยมีอายุยืนยาวขึ้น แต่มีการเพิ่มขึ้นของภาวะการเจ็บป่วยและภาวะทุพลภาพ ผลการวิจัยนี้ยืนยัน การขยายตัวของภาวะการเจ็บป่วยในประชากรไทย

ข้อเสนอแนะเชิงนโยบายที่สำคัญคือการส่งเสริมวิถีการดำเนินชีวิตที่มีสุขภาพ เช่น การออกกำลังกาย และการรับประทานอาหารที่มีประโยชน์ การเตรียมความพร้องของประเทศเพื่อรองรับประชากรสูงอายุ รวมทั้งการจัดบริการสาธารณะสำหรับผู้สูงอายุที่พิการ การเตรียมความพร้อมของครอบครัวและชุมชนในการดูแลผู้สูงอายุและผู้สูงอายุที่พิการเช่นกัน

สาขาวิชา ..วิจัยเพื่อการพัฒนาสุขภาพ.. ลายมือชื่อนิสิต ....
ปีการศึกษา.....2551............ ลายมือชื่ออ.ที่ปรึกษาวิทยานิพนธ์หลัก..............................
ลายมือชื่ออ.ที่ปรึกษาวิทยานิพนธ์ร่วม..............................
ลายมือชื่ออ.ที่ปรึกษาวิทยานิพนธ์ร่วม..............................

4889701920: MAJOR RESEARCH FOR HEALTH DEVELOPMENT
KEY WORDS: MORBIDITY / DISABILITY / MORTALITY / LIFE EXPECTANCY

ARAYA PRASERTCHAI : MORBIDITY EXPANSION AMONG THAI POPULATION. ADVISOR : PROF. SUTTHICHAI JITAPUNKUL, M.D., CO-ADVISORS: ASSOC. PROF. WICHAI AEKPLAKORN, M.D., Ph.D., VIPAT KURUCHITTHAM, Ph.D., 195 pp.

Average life expectancies of both genders in Thailand tend to increase due to declining birth and mortality rates. Additionally, average life expectancies in the elderly tend to increase considerably. A long life may be a life combining with good health, morbidity, and disability. The purposes of this study were to examine four kinds of trends 1) trends of chronic diseases (hypertension, diabetes) and health parameters (fasting plasma glucose, total cholesterol, and body mass Index) by aged-specific prevalence rates, 2) trends of the activities of daily living disabilities by aged specific rates, 3) trends in age-specific mortality rates of chronic diseases (ischemic heart disease, cerebrovascular disease, and cancers), and 4) trends of the proportion of active life expectancy to life expectancy at age 60 and over.

This was a cross-sectional study using secondary data which included morbidity, disability, and mortality data. The morbidity data were derived from the National Health Examination Survey consisting of questionnaire and health exam. The mortality data were extracted from the national vital statistics reports. The disability data were derived from Survey of Elderly in Thailand and estimated active life expectancies were calculated using the Sullivan Method.

Results show 1) increasing trends of chronic diseases and health parameters by aged-specific prevalence rates, 2) increasing trends of the activities of daily living disabilities by aged specific rates, 3) increasing trends in age-specific mortality rates of chronic diseases, and 4) declining trends of the proportion of active life expectancy to life expectancy at age 60 and over. In conclusion, Thai population may not only live longer, but also live with morbidity and disability. This study confirms the expansion of morbidity among Thai population.

Important policy recommendations are to promote healthy life style such as exercising and eating food full with nutrition, to prepare the nation for aging population including government services for disabled elderly, and to prepare family and community in caring for elderly and elderly with disability.

Field of Study: Research for Health Development Student's Signature...................................

Academic Year:..……2008………. Advisor's Signature..................................

Co-Advisor's Signature............................

Co-Advisor's Signature............................

ACKNOWLEDGEMENTS

It is my great pleasure to extend my sincere gratitude and appreciation to Professor Sutthichai Jitapunkul, my advisor, Associate Dr. Wichai Aekplakorn and Dr. Vipat Kuruchittham, my co-advisor, for their inspiration, encouragements, scientific guidance and supports throughout the study which enables me to complete the study successfully in time.

I would like to acknowledge the valuable guidance of Associate Professor Dr.Napaporn Chayowan, Associate Professor Dr.Vipan Prachuabmoh, Dr. Janya Pattara-apornchai, Doctor Somsak Chunharas, Assistance Professor Dr.Ratana Somrongthong, and Dr. Prathurng Hongsaranagorn.

I wish also to thank the Health Systems Research Institute, Bureau of Health Policy and Planning, Ministry of Public Health, and National Statistical Office for providing the morbidity, mortality, and disability data, respectively.

I also to sincere thanks to the Department of Medical Service, Ministry of Public Health, for financial support of Ph.D. Particularly, grant for research from the 90th Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund).

I would like to pay my sincere thanks to Dr.Kalya Earprasertsak from Thammasart University for kind words and edit some manuscript . Thanks to Ms. Taradee Khamya for explanations of life table. Thanks to my best friends, Sureerat Simla and Ratana Earprasertsak for their continuous collegial support. Deeply thanks for my parent for their remarkable support.

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LIST OF ABBREVIATIONS

HT	Hypertension
DM	Diabetes
IHD	Ischemic Heart Disease
CVD	Cerebrovascular Disease
TC	Total Cholesterol
FPG	Fasting Plasma Glucose
BMI	Body Mass Index
BP	Blood Pressure
LE	Life Expectancy
ALE	Active Life Expectancy
DFLE	Disability Free Life Expectancy
DLE	Disability Life Expectancy
ADLs	Activities of Daily Living
ICD-10	International Classification of Diseases on Health Related Problems the tenth revision
NHES	National Health Examination Survey
MOPH	Ministry of Public Health
ORA	Office of Registration Administration
NSO	National Statistical Office
SET	Survey of Elderly in Thailand
SPC	Survey of Population Change

CHAPTER I

INTRODUCTION

1.1 Background

Life Expectancy continues to increase in Thailand as a result of declining infant and age-specific mortality. Life Expectancy (LE) has also increased significantly. For example from 1960 to 2007, the Life Expectancy at birth for males increased from 53.64 (Jitapunkul & Bunnag, 1997) to 68 years(Population Reference Bureau, 2007). For females, the corresponding increase was from 58.74 (Jitapunkul & Bunnag, 1997) to 75 years (Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2007). By 2050 life expectancies are expected to be 74.9 years for male and 81.1 years for females (Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2007). The expectation of life at older ages is also increased which represents a decline in death rates at every age group (Human Resources Planning Division, 1995; Ministry of Public Health, 1994, 2000, 2003, 2005c). For example between 1986 and 1996 LE of the elderly at the age 60 increased from 15.52 to 20.19 years for males and from 18.56 to 23.89 years for females (Saito, Qiao, & Jitapunkul, 2003).

It has been recognized that increased LE is accompanied by both an increased active-life expectancy, and disability and terminal dependency (Olshansky, Rudberg, Carnes, & et al, 1991; Stout & Crawford, 1988). Three alternatives explanations for the evolution that related morbidity, disability, and mortality are types of theories about changes in morbidity and disability that go along with longer LE. Fried and colleagues (Fries, 1980, 1988) argued that with improvements in survival, the prevalence of disability will decrease and, therefore, the proportion of life lived with disability will also decrease. This theory is often called compression of morbidity. Conversely, other theories predict that the proportion of life lived with disability will increase as mortality declines—expansion of morbidity. Gruenberg (Gruenberg, 1977) and Kramer (Kramer, 1980) suggest that as the length of survival of individuals with chronic disorders such as Down's syndrome increases, the prevalence of these disorders will also rise. Others (Alter & Riley, 1989; Feldman, 1983; Olshansky, Rudberg, Carnes, Cassel, & Brody, 1991a; Shephard & Zeckhauser, 1980) suggest that improved survival among frail individuals who have higher expected incidence rates of disability will lead to an increased prevalence of disability. A third, "mixed" theory—dynamic equilibrium—predicts that the progression of chronic disease to severe disability will be slowed by medical intervention, which will lead to a decline in the prevalence of severe disability, but a rise in the prevalence of mild disability, increasing LE would also contribute to the latter (Murray & Lopez, 1997).

There are many studies on mortality, morbidity and disability conducted in Western countries, especially conducted in the United States (US). The simulation study in the US for the mid 1980s demonstrated that a population certainly could experience longer expected life but worsening health and speculated that such a pattern might be expected in the initial stage of declines in death rates associated with chronic disease (Crimmins, Hayward, & Saito, 1994). The US has a relatively long life expectancy – and the data there suggest dynamic equilibrium (Howse, May 2006). In Australia, the study of trends in healthy life expectancy in the elderly between 1978 and 1998 showed the positive trends in healthy life expectancy, supporting the view that elderly people in the 21st century might not only live longer but also live longer in good health (Doblhammer & Kytir, 2001). This result was consistent with the compression of morbidity hypothesis (Doblhammer & Kytir, 2001). Some studies supported the expansion of morbidity hypothesis. In England and Wales, Bebbington found that the LE with chronic disability had risen (A. Bebbington, 1988). LE in the United Kingdom (UK) is lower than in Australia, but higher than in Austria, and according to Robine and Michel, the UK data on health expectancies fit in with their hypothesis: evidence of a compression of morbidity in the 1980s and early 1990s followed by an apparent expansion of morbidity (Howse, May 2006). Similarly, in Taiwan, Zimmer, Martin and Chang found that the prevalence of functional limitations among the elderly was increasing between 1993 and1999 (Zimmer, Martin, & Chang, 2002). The study from France provided consistent evidence with the dynamic equilibrium hypothesis, which the prevalence of chronic diseases increased as mortality decreased, but on average, the prevalence states were less severe and disabling. Manton, Stallard and Corder also found the similar result to this concept (Manton, Stallard, & Corder, 1995).

While in Thailand previous studies (Jitapunkul & Bunnag, 1997; Rakchanyaban, 2002; Saito et al., 2003) found elderly women live longer than elderly men but they also spent more years with disabilities. The proportional time of disability for both men and women increase with age (Jitapunkul, 1999). Jitapunkul and his colleagues also found that Active Life Expectancy (ALE) increased from 15.2 years in 1989 to 18.6 years in 1996 for Thai males aged 60 and from 17.4 years to 21.3 years for Thai females aged 60 over the same period, while LE increased from 16.0 years to 20.3 years for Thai males and from 19.1 years to 23.9 years for Thai females (Saito et al., 2003). However, the proportion of ALE decreased for both sexes between 1989 and 1996 (Saito et al., 2003). These findings did not confirm that there was an expansion or compression of morbidity/ disability in Thailand.

Therefore, it is not clear whether longer life expectancy will be accompanied by better health. Currently, evidences in Thailand have shown expansion of the morbidity and disability in age 60 and over among Thai population (Chayovan, 2002; Jitapunkul, 1999, 2000; Jitapunkul & Bunnag, 1997; Khumya & Jitapunkul, 2000). These situations also happened in developed countries. Thai populations are estimated to have more health problems than in the past because (a) the process of population aging of Thailand is changing more rapidly than that in the West (Jitapunkul, 1999) (b) an effect of urban environment such as a change in life style or an increase in the prevalence of chronic diseases (Jitapunkul, 2000; Saito et al., 2003). Including, Jitapunkul and colleagues suggested that with urbanization occurring very rapidly, morbidity-disability may be on the rise in Thailand (Saito et al., 2003). If so, it will affect the estimated problems and need of Thai population in the future. Hence, it is of crucial policy importance because it affects health and long-term care needs of Thai population.

There are methods to investigate the quality of the longer life and becomes a major issue. Health expectancy makes it possible to assess changes in mortality, morbidity, and disability conditions simultaneously (J.M. Robine, Romieu, & Cambois, 1999). Changes in the difference between the three indicators allow the occurrence of the difference health scenarios proposed to assessed: expansion of chronic diseases and disabilities, compression of morbidity, or dynamic equilibrium (J.M. Robine et al., 1999). The researcher will use health expectancy in terms of ALE to investigate the quality of the longer life. The concept of ALE refers to an average number of years that a person expects to be free from limitation of function due to one or more chronic disease conditions. Measures of ALE often focus on the ability of persons to complete activities of daily living (ADLs), a common factor leading to the need for long-term care. Recent studies using ADLs measures have shown varied trends in disability (V.A. Freedman, Martin, & Schoeni, 2002). ALE is another useful measure for summarizing morbidity and disability experience and for comparing within population. Therefore, this study will examine the trends of aged specific prevalence of chronic diseases, trends in aged specific prevalence of disability, and trends of mortality rates. These points bring about research questions whether or not the Thai population is going to expansion of morbidity and disabilities. Does living longer mean living healthier? The quality of the population life will be depicted in term of the proportion of ALE to life expectancy.

1.2 Research Questions

1. Is morbidity and disability of the population expanding in Thailand?

2. Does living longer mean living healthier in Thailand?

1.3 Hypotheses

1. Trends of chronic diseases (hypertension, diabetes) and health parameters (fasting plasma glucose—FPG, total cholesterol—TC, body mass Index—BMI) by aged-specific prevalence rates among the population has been increasing.

2. Trends of the ADLs disabilities by aged specific rates among the population have been increasing.

3. Trends in age-specific mortality rates of chronic diseases (ischemic heart disease, cerebrovascular disease, and cancers) among the population have been increasing.

d) Trends of the proportion of active life expectancy to life expectancy at age 60 are decreasing.

1.4 Objectives

1. To study trends of age-specific prevalence rates of chronic diseases (hypertension, diabetes) and health parameters (FPG, TC, BMI).

2. To study trends of age-specific prevalence rates of ADL disabilities.

3. To study trends in age-specific mortality rates of chronic diseases (ischemic heart disease, cerebrovascular disease, and cancers).

4. To study trends of the proportion of active life expectancy to life expectancy at age 60 and over.

1.5 Expected Benefits

The development of indicators summarizing mortality and morbidity has provided an important tool for understanding how health status and length of life change in actual populations and whether there has been an expansion or contraction of healthy life. This indicator provides a yardstrick for measuring the achieved balance between increasing the length of life and increasing the quality of life.

Results of this study allow policy makers to better understand issues of aging population, to know health scenario, trends of health status (morbidity, disability, and mortality), and to know the appropriate health indicators used to monitor health status among Thai population. Providing appropriate health policy can be established to promote health and long-term care needs of Thai population.

1.6 Operation Definitions

Population is defined as male and female age 15 years and over.

Elderly is defined as male and female age 60 years and over.

Health status is the level of health of the population, integrating mortality (length of life) and morbidity (disability or functional capacity). Typically, it measured in units of health expectancy. In this study, the researcher used health expectancy in term of active life expectancy.

Chronic diseases are hypertension and diabetes. Since chronic disease can share common risk factors or one disease can act as a risk factor for a second disease, so selected risk factors ie. hypercholesterolemia, overweight, and obesity are included for explaining as important risks factors that would relate to hypertension and diabetis. Chronic diseases and selected risk factors are measure by prevalence.

Health parameters are fasting plasma glucose, total cholesterol, and body mass index. In this study, health parameters are measured by means.

According to the WHO guidelines, definitions of chronic diseases and health parameters in this study were as follows:

a) Hypertension is defined, according to the WHO guidelines, as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg, and/or use of antihypertensive medication or previously diagnosed hypertension.

b) Diabetes was defined as FPG ≥126 mg/dl, use of medication (oral antiglycemic agents or insulin) for the treatment of diabetes during the previous 2 weeks, or a report of a previous diagnosis of diabetes by a medical doctor. Diagnosed diabetes was defined as meeting the criteria for diabetes and having a previous diagnosis of diabetes by a medical doctor.

c) High cholesterol was defined as total serum cholesterol ≥200 mg/dl.

d) BMI, overweight and obesity were defined on the basis of measurements of BMI, calculated as weight in kilos divided by height in metres squared (kg/m^2). Both were classified according to World Health Organization (WHO) criteria, whereby obesity is defined as a BMI ≥ 30 kg/m^2, and overweight is defined as BMI ≥ 25 kg/m^2 (World Health Organization).

Mortality rates of chronic diseases were mortality rates from ischemic heart disease, cerebrovascular, and cancers that would be results from chronic diseases and risk factors such as hypertension, diabetes together with hypercholesterolemia, overweight, and obesity. They were part of the 10 leading cause of death rates per 100,000 populations that was classified by international statistical classification of diseases on health related problems the tenth revision (ICD-10).

Life expectancy (LE) refers to the average number of years an individual is expected to live if the current pattern of mortality continues to apply.

Activities of daily living (ADL) disability are considered essential to ensure the independent living or active life. A person is defined as "having ADL disabilities" or "disabled" if he or she reported being unable to do by himself or herself and without aids on one or more of activities of daily living. These activities are eating, dressing, bathing, and toileting.

Active life expectancy (ALE) or Disability-free life expectancy (DFLE) refers to the average number of years an individual is expected to live without restriction in number of activities of daily living (ADL) as mentioned above.

1.7 Conceptual Framework

All health status assessment approach—the functional approach: the consequences of diseases and concept of disability— and a general model of health transition were applied in the study, except for the bio-medical approach. Since the bio-medical approach only focuses on the disease, it unfits to the aims of this study that center around the consequences of disease. The functional approach was suitable for the assessment of the consequences of the chronic morbidity on the daily life. The ability to function represented an important indicator of the dependence or independence of the older people. Activities of Daily Living (ADLs) was used because they represent personal care routines and basic functioning, which were more likely to be culturally universal, and thus, appropriate in the calculation of composite measure of functional disability for subgroups comparison.

A general model of health transition lies in its ability to simultaneously assess trends of mortality, morbidity, and disability. Thus, to assess the likelihood of different health scenarios which have been proposed: a pandemic of chronic diseases and disabilities (Gruenberg, 1977; Kramer, 1980), a compression of morbidity (Fries, 1980, 1989), contradictory evolutions including the scenario of dynamic equilibrium (Manton, 1982), or a postponement of all morbid events (diseases, disabilities and mortality) at older ages (Strehler, 1975).

The procedures that were used for analysis showed as follows:

1. Trends of age-specific prevalence rates of chronic diseases: prevalence of chronic diseases refered to the percentage of population with chronic diseases and mean of health parameters during 1992 and 2004. Population age 15 years and over was categorized by age specific prevalence rate, sex, and geographic regions

2. Trends of age-specific prevalence rates of ADL disabilities: prevalence of disability which refered to the percentage of population with disability during 2002 and 2007. Population aged 60 and over was categorized into two group, non-disabled and activities of daily living disability. Person with ADLs disability were defined as those who have difficult limitations in performing any one or more of these three activities: eating, dressing and bathing. The rated of disabilities were categorized by age, sex, and geographic regions.

3. Trend of age-specific mortality rates of chronic diseases: age-specific mortality rate used mortality data of population with selected chronic disease during 1998 to 2006. The rated of mortality were categorized by age, sex, and geographic regions.

4. Active life expectancy is an index of population health that combinrs mortality and disability, and is an accepted marker of the quality of life over the life cycle. The proportion of trends of active life expectancy to life expectancy which refered to proportion of the remaining year spent without disability used to compare the quality of life between sex at age 60 and over.

CHAPTER II

LITERATURE REVIEW

This study aims to (a) study trends of age-specific prevalence rates of chronic diseases (hypertension, diabetes) and health parameters (FPG, TC, BMI) (b) study trends of age-specific prevalence rates of ADL disabilities (c) study trends in age-specific mortality rates of chronic diseases (ischemic heart disease, cerebrovascular disease and cancers) (d) study trends of the proportion of active life expectancy to life expectancy at age 60 and over. In this chapter, the constructs important for the study the following topic are reviewed.

2.1 Definition of health

2.2 Health status assessment approach

2.2.1 Bio-medical Approach

2.2.2 The functional Approach: the consequences of disease and concept of disability

2.3 Trends of morbidity, disability, and mortality in Thailand

2.4 Theory of the evolution of Morbidity, Disability, and Mortality

2.4.1 The compression-of-Morbidity Hypothesis

2.4.2 The expansion-of-morbidity Hypothesis

2.4.3 The Dynamic-Equilibrium Hypothesis

2.5 A general Model of Health Transition

2.6 Health Expectancy

2.1 Definition of health

The multi-dimensional nature of health is empirically "defined" by the multiplicity of definitions, some of which are largely perceptual whilst others are largely functional (J. M. Robine, Jagger, & Egidi, 2000). For World Health Organization, “Health” is a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity" (United Nations, 1946). Some definitions are more dynamic but health is not always good or bad and it is well accepted that health is distributed in a continuum going from a state of perfect health to death. Each individual makes transitions between health states through his life, passing ultimately to death (J. M. Robine et al., 2000).

2.2 Health status assessment approach

Due to the epidemiological transition has changed from communicable and acute diseases to long term chronic disease, the view of health has changed from endurance through freedom from disease and individual’s ability to carry out daily activities to the current view of health as well-being (quality of life) (Minaire, 1992). The important approaches will discuss in details:

2.2.1 Bio-medical Approach

This approach discovered favor with the advances in bacteriology, immunology, surgery, diagnostics and particularly progress in pharmacology. The analytic-descriptive approach to diseases played a key role: diseases were considered as separate items, and expertise was highly specialized and divided to meet the requirements of diseases (J. M. Robine et al., 2000). In this model, health is described as an absence of disease. Health-diseases are two opposites and not two endpoints of the same whole. The disease develops along a clear cause-effect path, such that health recovery is determined by disease-treatment. Treatment is centered on the disease, while mental, emotional or physiological conditions of the individual are independent (J. M. Robine et al., 2000).

Finally according to this approach only health professionals can heal and recognize diseases (diagnoses) and decide treatment while patients should only passively follow the professional's recommendations. However, defining bad health by the presence of disease worked well when the most common diseases were infectious diseases with known aetiologies (J. M. Robine et al., 2000).

With epidemiological change and keeping the biomedical model approach to health, biological or physical causes determine disease resulting in a clinical picture, partial or total impairments and/or functional limitation of the individual (World Health Organization, 1980).

In the biomedical approach, the body is the key element, determining health or illness. Psychological and social issues are barely acknowledged although a biopsychosocial model has been proposed to address this (Engel, 1977). Mental illness represents a grey area between physical health and illness (J. M. Robine et al., 2000).

2.2.2 The Functional Approach: The consequences of disease and concept of disability

a) Model of the International Classification of Impairments, Disabilities, and Handicaps (ICIDH)

The International Classification of Impairments, Disabilities and Handicaps (ICIDH) of the WHO (World Health Organization, 1980) is a classification of the consequences of disease essentially developed by Wood (Wood, 1975) as a supplement to the International Classification of Disease (ICD). There are four levels—diseases or disorders, impairments, disabilities and handicaps. These distinctions correspond to the succession of events that may occur following disease: (a) an abnormality appears within the individual—the disease; (b) one becomes aware of the fact and exteriorizes the pathological state—the impairment(s); (c) the individual's ability to act or behave is altered, the disability reflecting the consequences of impairments in terms of functional performance and activities of the individual; (d) the perception of the disability or the alteration of behaviors or functioning which results from it leads to a handicap for the affected individual— the pathological state is socialized by the handicap (J. M. Robine et al., 2000). (Figure1)

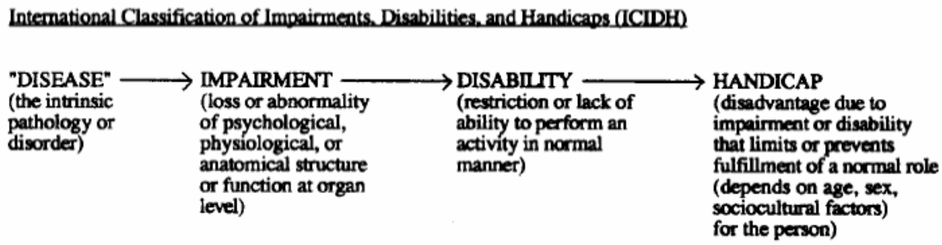


Figure 1 International Classification of Impairments, Disabilities and Handicaps (ICIDH): integration of concepts (WHO, 1980)

b) The International Classification of Impairments, Activities and Participation

In the present state of revision of the ICIDH-2, now called the International Classification of Functioning and Disability (World Health Organization, 1999) (Beta-2 full version July 1999), “functioning” and “disability” are umbrella terms covering the three new dimensions: (a) body functions and structure; (b) activities at the individual level; and (c) participation in society. The Body dimension comprises two classifications (J. M. Robine et al., 2000): one for functions of body systems, and one for the body structure. The Activities dimension covers the complete range of activities performed by an individual, with the chapters organized from simple to complex activities. The Participation dimension classifies areas of life in which an individual is involved, has access to, has societal opportunities or barriers, the domains being organized from simple to complex areas. Functioning and disability are conceived as dynamic interactions between health conditions and contextual factors, the contextual factors including both personal and environmental factors (J. M. Robine et al., 2000) (Figure 2)

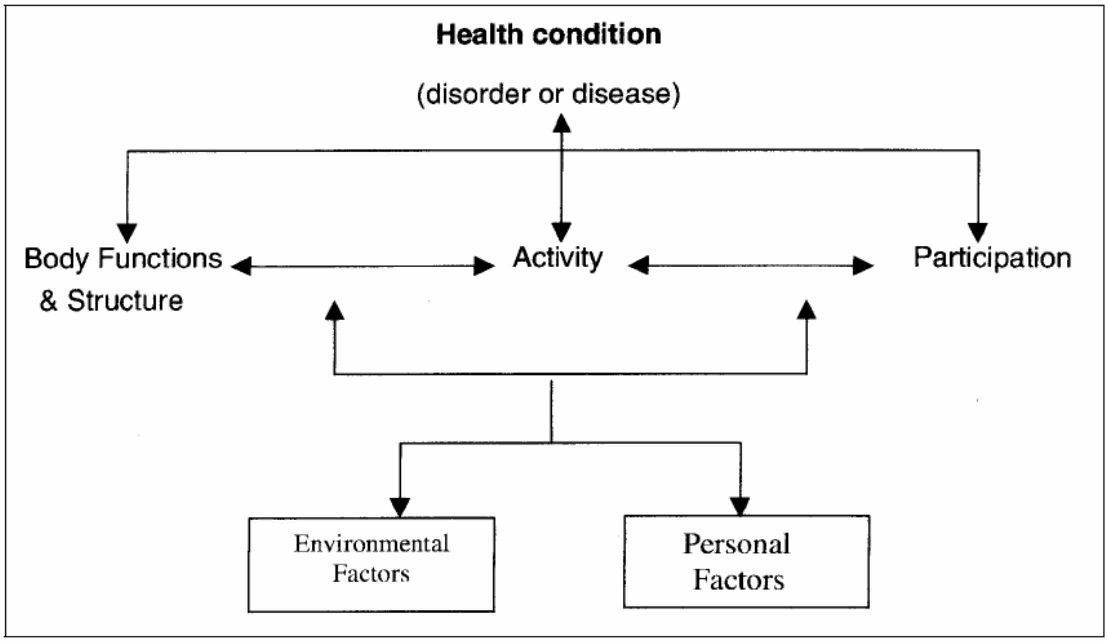


Figure 2 International Classification of Functioning and disability (ICIDH-2) (World Health Organization, 1999)

c) Nagi's model

A first conceptual clarification of terms concerning the consequences of disease and disability was proposed by Nagi (Nagi, 1965) with revisions in 1976 and

1991. Nagi distinguishes between four phenomena of which the first is active pathology or disease. Impairments are defined as anatomical, physiological, intellectual or emotional abnormalities or losses. Nagi noted that if all disease implies impairments, all impairments do not imply a disease in the sense of active pathology. Functional limitations are limitations in performance at the level of the whole organism or person and comprise three dimensions—physical, emotional and mental. Physical refers to sensory motor functioning of the organism as indicated by limitations in such activities as walking, climbing, bending, reaching, hearing, etc.(Nagi, 1976). Disability concerns inability or limitations in the fulfillment of activities and social roles in relation to work, the family and an independent life (Nagi, 1991).

Active Pathology > Impairment > Functional limitation >Disability

Figure 3 Nagi Taxonomy of Disability

d) The model of disablement process

“Disablement” refers to impacts that chronic and acute conditions have on the functioning of specific body systems and on people’s abilities to act in necessary, usual, expected and personally desired ways in their society (L.M Verbrugge & Jetti, 1994). The term “disablement” is general, covering all consequences of pathology for functioning. The term is routinely used by United Kingdom and European researchers; it may be new to some North American readers. The term “process” reflects interest in the dynamics of disablement; that is, the trajectory of functional consequences over time and the factors that affect their direction, pace, and patterns of change (L.M Verbrugge & Jetti, 1994).

Conceptually, the disablement process of Verbrugge models is an extension and elaboration of the Nagi's model (J. M. Robine et al., 2000). This model reaffirms from pathology to various kinds of functional outcomes in language that go well with medical and survey research. Pathology refers to biochemical and physiological abnormalities that are related and medically labeled as disease, injury or congenital/ development conditions (L.M Verbrugge & Jetti, 1994). Impairment refers to dysfunction and significant structural abnormalities in specific body systems (L.M Verbrugge & Jetti, 1994). Functional limitation refers to any restriction in performing fundamental physical actions (overall morbidity, discrete motions and strengths, trouble seeing, trouble hearing and trouble communicating) and mental action (central cognitive and emotion functions) used in daily life by one's age-sex group (L.M Verbrugge & Jetti, 1994). Disability refers to experience difficulty doing activities in any domain of life (L.M Verbrugge & Jetti, 1994). Current studies often focus on just 3 domains: personal care (basic activities of daily living; BADL or ADL), household management (instrumental activities of daily living; IADL), and job (paid employment) (L.M Verbrugge & Jetti, 1994). ADLs are abilities to eat, toilet, transfer (get in and out of bed/chair), dress and bathe. IADLs are abilities to prepare own meals, do light housework, manage own money, use the telephone, and shop for personal items. ADLs are necessary for survival; IADLs are necessary for maintaining a dwelling in a given sociocultural setting. But there are other common and valued domains of activity: house and yard chores (besides those noted as IADLs); shopping and errands; job (paid employment); sleep; care for children and others; hobbies and other leisure at home; active sports and physical recreation; entertainment away from home; religious services or activities; public service/clubs/adult education; socializing with friends and relatives; local transportation; and distant trips (L.M Verbrugge & Jetti, 1994).

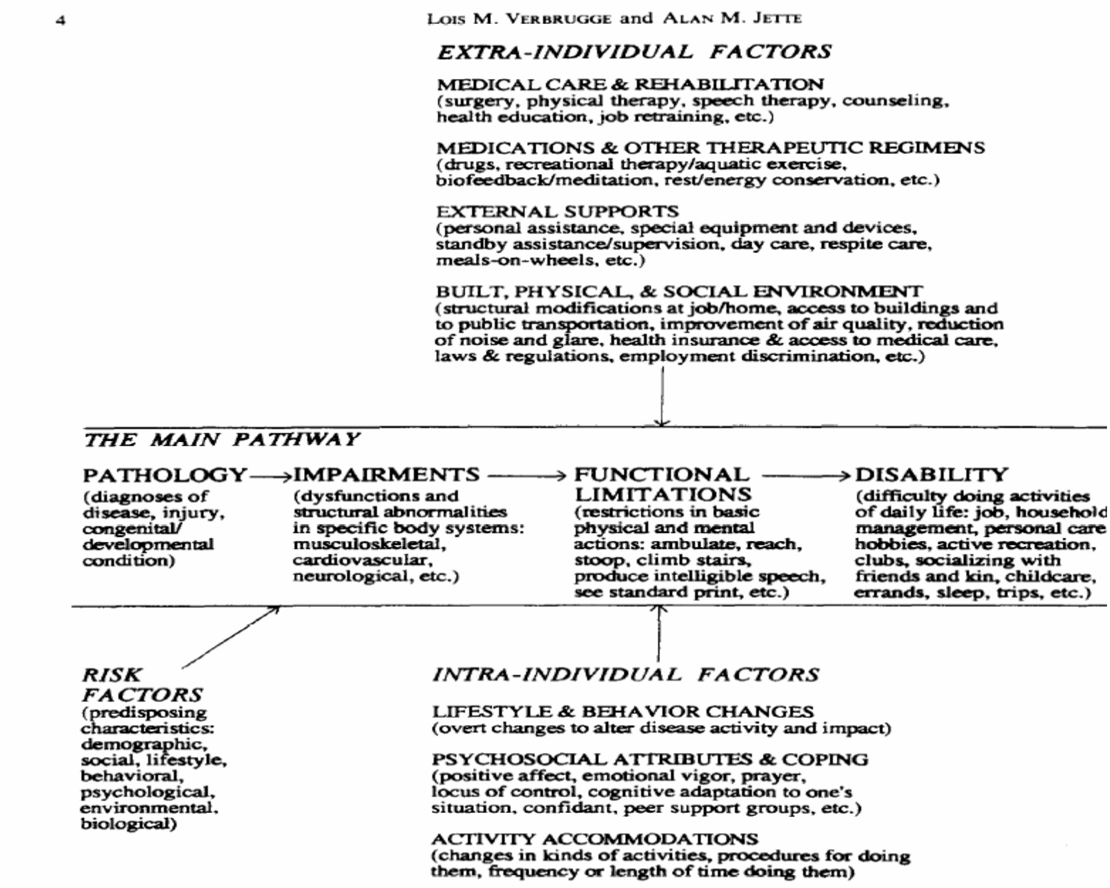


Figure 4 The disablement process (L.M Verbrugge & Jetti, 1994)

The Nagi's model and the disablement process conceptualize the process as proceeding from disease to and impairment, to functioning problem and loss, to disability; that is (J. M. Robine et al., 2000). Moving from disease to an inability to fulfill a social role, the important value of these model in that they clarity how external forces might affect change or differences in level of disability (Saito, Crimmins, & Hayward, 1999).

Physical dependence of old people is an old concept in the field of gerontology (Katz, Ford, Moskowitz, Jackson, & Jaffer, 1963). The current classification of handicaps, WHO (World Health Organization, 1980) notes that while it is important to have fundamental independence in physical and material activities, the integration of handicap in the term “dependence” obscures the social needs.

Therefore, the activity restriction is assessed by difficulty or impossibility in performing activities which are considered as essential to accomplish a social role in the society, such as personal care activities ensuring own minimal independence in daily life (feeding, bathing, dressing...) (J. M. Robine et al., 2000). The functional limitation is placed at the level of the body and its functioning. At this level one does not intend to measure the difficulty in the performance of activities that are essential in individual’s life, but to test for declining functions that would either prevent individuals who suffer them from normal performance of essential activities or lead them to compensatory strategies for lessening the loss of these functions (J. M. Robine et al., 2000). In health interview surveys, functional limitations are not tested as they might be in examination surveys (J. M. Robine et al., 2000). The presence of functional limitations is determined by placing the subjects being interviewed in common situations requiring movements (or actions) that acknowledge specific body functions, and by asking about the ability to perform them: the ability to grab, or to climb stairs, or to turn taps, etc (J. M. Robine et al., 2000).

Summary

As already mention, health was empirically "defined" by the multiplicity of definitions, some of which were largely perceptual whilst others were largely functional (J. M. Robine et al., 2000). Subsequently, there was no particular concept that should be the standard of health status assessment. All of these approaches were important because the history of these approaches has relation each other. All of these approaches were applied in the study, except for the bio-medical approach. Since the bio-medical approach only focuses on the disease, it unfitted to the aims of this study that center around the consequences of disease. The functional approach was suitable for the assessment of the consequences of the chronic morbidity on the daily life. The ability to function represents an important indicator of the dependence or independence of the older people. Activities of Daily Living (ADLs) were used because they represented personal care routines and basic functioning, which were more likely to be culturally universal, and thus, appropriate in the calculation of composite measure of functional disability for subgroups comparison. So it has become widely accepted as sensible measure of health status (Doblhammer & Kytir, 2001). Different concepts offered answer to unrelated question and can be used to monitor different aspects of health.

2.3 Trends of morbidity, disability and mortality in Thailand

2.3.1 Morbidity

Due to Thailand has confronted from infectious diseases to chronic diseases (World health Organization, 2002). The epidemiological transition shows an increase in the average age of a population; there is a transition of health behavior pattern to a Western life style of consumption; and there is a transition of morbidity pattern from communicative disease to non-communicative disease (Ministry of Public Health, 2005c). Chronic diseases have become important health problems in Thailand, resulting from change in life style, socio-economic condition, and industrial development. According to the National Health Examination Survey in1991, the pattern of chronic disease among the Thai older adults was quite similar to those of developed countries. About 23% of the age reported poor health (Chooprapawan, 1996) and there major health problem was deterioration due to physical change. Back pain, osteoarthritis, hypercholesterolemia, and hypertension were report as their most common chronic condition (Jitapunkul & Bunnag, 1997).

Since the year of 1975 to 2005, it is found that every region of Thailand is experiencing an increase in morbidity and death from chronic disease (Ministry of Public Health, 2005c). Particularly, level and trend of in and out-patient over the period 1981-1998, number of out-patient were inclined (Ministry of Public Health, 2003). In 1981, number of out-patient was only 17.7 million. In 1998 the number was increased approximately 5 times to be 86.9 millions. And it was 91.8 millions in the year 1999 (Ministry of Public Health, 2003).

During 1999 to 2005, respiratory system disease has always been on the top of the list as well as the disease in digestive system which come second; while the diseases in muscular and skeletal systems and those in circulatory system take turn to be the third (Ministry of Public Health, 2005c). It is noticeable that morbidity groups of behavior-related disease is on the rise, i.e. the groups of diseases related to endocrine glands, nutrition and metabolism; the same rise in also found n diseases which are related to condition of mortality and behavior (Ministry of Public Health, 2005c).

Even though there is limitation of accuracy in registering morbidity data for evaluation health status. However, morbidity data is contributed to know size of morbidity problem (Jitapunkul, Chayowan, Yodpeth, & et al, 2002).

2.3.2 Disability

Projections of disabled elderly for 2003-2023 in Thailand by the Health System Research Institute and Institute for Population and Social Research (Health Research System Institute & Institute for Population and Social Research, 2003) found the number of disabled men and women elderly is projected to double in 20 years. The projection indicates that the total number of disabled elderly will steadily increase from 195,000 in 2002 to 433,000 by 2023. The annual growth rate of projected disable elderly is about 6 per cent. Although the disabled elderly is projected to become larger over the next 20 years, the number of disabled elderly is expected to increase faster and will peak at a later period.

2.3.3 Mortality

Death is the other factor effecting population change and the popular indices to measure deaths are mortality rate, mortality rate by age and sex, life expectancy at birth, infant mortality rate, and maternal mortality rate (Ministry of Public Health, 2000, 2003). In the past, death trends to be decreasing continuously and rapidly as a consequent of improving of medical care and public health system along with socio-economic growth (Ministry of Public Health, 2000, 2003). Consequently, life expectancy at birth of the population increase gradually. And male has higher mortality rate than female in every age group (Ministry of Public Health, 2000).

In the past, statistics on causes of death were incompleteness and almost they were ill-defined group more than 30 % when compared with the total figures (Ministry of Public Health, 2000). In addition to the deaths have known cause, they have some items that cannot define and unreliable because the causes are mode of death and make the errors and incompleteness (Ministry of Public Health, 2000).

Since 1996 causes of deaths have accurate. This is because the causes of death by ICD 10 are accuracy (Ministry of Public Health, 1994, 2000, 2005c).

In 1999, data of death by age from Registration Administration Bureau Department of Local administration Ministry of Interior shows that pattern of death of Thai people was not different from the past (Ministry of Public Health, 2000). In the future, mortality rate would be increased because of elderly group increasing (Ministry of Public Health, 2000).

The verification causes of death from the death certificate in 2000 found that the first five leading causes of death was cancer (Ministry of Public Health, 2000). Cardiovascular disease, external causes, hypertension and stroke, pneumonia and other pneumonia disease (Ministry of Public Health, 2000). The next four leading causes of death was nephritis, disorder of kidney, disease of liver and pancreases, and injury from suicide, homicide and others, tuberculosis and hemorrhagic fever respectively (Ministry of Public Health, 2000). Also, from the report on causes of death in 2005 of Ministry of Public Health showed the leading cause of death rate per 100,000 population found that the first was 81.4 of cancer trending more increasingly in every year and the rank 2 and 3 are 57.6 of accident and poisoning and 29.2 of hypertension and cerebrovascular disease respectively (Ministry of Public Health, 2005c). In the part of carcinoma disease, the highest death rate was 20.2 of malignant neoplasm of liver and intra hepatic bile duck besides, the three follower after were 12.9 of malignant of neoplasm of trachea, bronchus and lung, 6.1 of malignant neoplasm of breast female and 4.7 of malignant neoplasm of cervix uteri respectively (Ministry of Public Health, 2005c).

Therefore, trends of causes of death from the top ranks of causes of death is found that morbidity of non-communicable disease group —cancer, hypertension etc

(Ministry of Public Health, 1994, 2000, 2005c). Also, the leading causes of death among Thai older adults were cardiovascular disease, cancer, and cerebrovascular disease (Jitapunkul & Bunnag, 1997). Death could reflect efficiency of medical care and public health system and demonstrate quality of life of population.

2.4 Theory of the evolution of Morbidity, Disability, and Mortality

There are three hypotheses based on the relation of mortality, morbidity, and disability. Numerous studied explained these hypotheses:

2.4.1 The compression-of-Morbidity Hypothesis

The compression of morbidity hypothesis (Fries, 1980, 1983, 1989, 1993) states that the length of human life is fixed, that life expectancy is reaching this limit, that chronic disease and related disability can be postponed to older ages by change in life style, and that the physiological (e.g. serum cholesterol) and psychological (e.g. memory) markers of the ageing process can be modified. Fried argues that there is a natural limit to the life span (i.e. the genetically endowed limit to life for a single individual if free of all exogenous risk factors). A linear decline in organ reserve with increasing age parallels the decline in the ability to restore homeostasis. Eventually, the smallest perturbation prevents homeostasis being restored and caused "natural death", which may even occur without disease. Chronic diseases can be postponed or even prevented by adopting a healthy life style, such as avoiding overweight, quitting smoking and doing exercise. As a result, the number of years with morbidity can be compressed between the increasing age at onset of morbidity and the fixed mean aged at death expressed in terms of the survival curves of the WHO model. This hypothesis states that the mortality curve does not change substantially, whereas the morbidity and disability curves move outwards. As a result the area between the mortality and morbidity/ disability curve (i.e. life expectancy with morbidity/disability) decreases (Nussdelder, 2003).

2.4.2 The expansion-of-morbidity Hypothesis

The expansion of morbidity hypothesis anticipate the mortality reduction produce more years with morbidity and related disability (Gruenberg, 1977; Kramer, 1980; Olshansky, Rudberg, Carnes, Cassel, & Brody, 1991b; L. M. Verbrugge, 1984). Mortality reductions might produce this expansion in two ways. First, the increased survival of person with chronic conditions due to medical intervention might prolong the lives of the seriously chronically ill. Expressed in terms of the survival curves of the WHO model, the mortality curved moves outwards, whereas the other curves remain unchanged. In addition, increased survival might push the saved population into the oldest-old ages where the risks of non-fatal diseases of aging are high. Hence, declining mortality from fatal diseases produces a population with high risks of chronic morbidity and related disability and thus leads to a shift in the distribution of causes of disability from fatal to non-fatal diseases associated with old age. This second mechanism cannot be easily illustrated with the WHO model, although it is taken into account in the life-table model by default (Nussdelder, 2003).

2.4.3 The Dynamic-Equilibrium Hypothesis

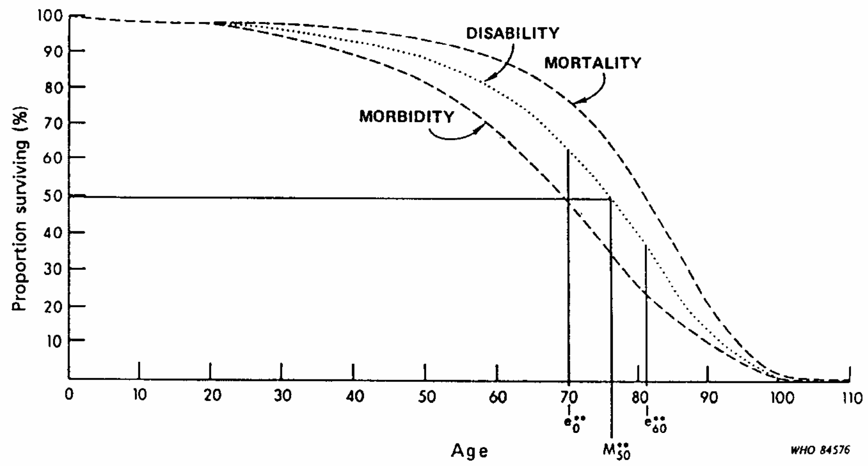
Manton (Manton, 1982) proposed the dynamic equilibrium hypothesis. This hypothesis states that increased survival produces an increase in years with severe morbidity and disability remain relatively constant, because medical interventions or life style changes reduce the rate of progression of chronic diseases. When disability is interpreted as severe morbidity, this hypothesis states that the area between the mortality and morbidity curves increase, because the mortality curve moves faster outwards than the morbidity curve. The area between the disability (here: severity morbidity) and mortality curves does not increase according to this hypothesis (Nussdelder, 2003).

2.5 A general Model of Health Transition

The survival-curve model, originally introduced by the WHO in 1984 (World Health Organization, 1984), enables a direct assessment of the consequences of increase longevity for population health and can be used to describe and visualize the possible associations between morbidity, mortality and population health (Figure 5). The model captures the dynamic of mortality, disability, and morbidity in a relatively standardized way. It consists of three survival curves, the mortality curve, the disability curve, and the morbidity curve, which represent the proportion of individuals in a cohort who can expect to survive without disability and to survive without morbidity (Nussdelder, 2003).

This model shows the different states: total survival, disability-free survival and survival without disabling chronic disease. This leads naturally to life expectancy (the area under the mortality curve), disability-free life expectancy (the area under the disability curve) and life expectancy without chronic disease (the area under the morbidity curve) (EHEMU Country Reports, 2005). The relevance of this general model of health transitions lies in its ability to simultaneously assess the evolution of mortality, morbidity and disability and thus to assess the likelihood of different health scenarios which have been proposed: a pandemic of chronic diseases and disabilities (Gruenberg, 1977; Kramer, 1980), a compression of morbidity (Fries, 1980, 1989), contradictory evolutions including the scenario of dynamic equilibrium (Manton, 1982), or a postponement of all morbid events (diseases, disabilities and mortality) at older ages (Strehler, 1975).

If the value of life expectancy with disability (LEWD or DLE) decreases, there is an absolute compression of morbidity; if the disability free life expectancy (DFLE or ALE) decreases there is an absolute pandemic of morbidity; if the part of life with disability decreases without the value of LEWD decreasing (it may even increase) there is a relative compression of morbidity; if the part of life without disability decreases without the value of DFLE decreasing (it may even increase) there is a relative pandemic of morbidity; if DFLE/LE is constant there is an equilibrium (J.M. Robine & Mathers, 1993). Nusselder (Nusselder, 1998) proposed a revised classification distinguishing between absolute compression and absolute expansion according to the change in the number of years lived with disability and between relative compression and relative expansion of disability according to the change in the percentage of years lived with disability. Thus any particular situation can be classified as a combination of absolute compression or expansion, combined with relative compression or expansion. Manton's (Manton, 1982) theory of "dynamic equilibrium" corresponds to a scenario where the number of years lived with disabilities - all levels taken together - increases, while the number of years lived with severe disabilities remains constant or even decreases within life expectancy.



e_0** and e_{60}** are the number of years of autonomous life expected at birth and at age 60, respectively.
M_{50}** is the age to which 50% of females could expect to survive without loss of autonomy.

Source: World Health Organization. The uses of epidemiology in the study of elderly: Report of WHO scientific group on epidemiology of aging. Technical Report Series 706. Geneva, WHO,1984.(Hubert, Bloch, Oehlert, & Fries, 2002)

Figure 5 The observed mortality and hypothetical morbidity and disability survival curves for females United States of America, 1980

2.6 Health Expectancy

Health expectancies are lengths of time in different stages of health—life expectancy is composed of lengths of time spent in different states of health until death(Jagger, 1999). The sum of complementary health expectancies is always equal to life expectancy (J. M. Robine et al., 2000). The idea of health expectancy had been put forward by Sanders as early as 1964 and a first method of calculation had been proposed by Sullivan in 1971.

Being independent of the size of populations and of their age structure, health expectancies allow direct comparison of the different groups that make up populations: e.g. sexes, socio-professional categories, regions. Thus, by means of health expectancies, countries may estimate health differentials between men and women, between the different socio-economic categories or among regions and over time(J. M. Robine et al., 2000). Health expectancies, in particular disability-free life expectancy, were first developed to address whether or not the lengthening in life expectancy is being accompanied with an increase in time lived in bad health (J. M. Robine et al., 2000).

The calculations of health expectancies rely on observed data: period life tables together with prevalence of health states obtained from the results of censuses and various surveys (Living conditions, Health, Disability, and Labor Force). Most of the calculations of health expectancy are based on a general model of health transitions that allows a direct assessment of the health consequences of increasing survival (World Health Organization, 1984).

The relevance of health expectancy indicators lies in their ability to simultaneously assess the evolution of mortality, morbidity and disability and thus to assess the likelihood of different health scenarios which have been proposed: “a pandemic of chronic diseases and disabilities”, “a compression of morbidity”, or contradictory evolutions including the scenario of “dynamic equilibrium”(J. M. Robine et al., 2000).

There are three methods—prevalence-base life table (The Sullivan Method), multiple-decrement life table methods, and increment-decrement or multistate life table method:

2.6.1 Prevalence-base life table (The Sullivan Method)

The prevalence-based life table method represents the earliest technique to calculate healthy life expectancy. Developed originally in the 1930s to examine how long individuals could be expected to work in their life times. The approach has been applied for almost three decades to calculate healthy life expectancy. The underlying stochastic process governing moves between health states is relatively uncomplicated.

In this model, life is assumed to follow an evolutionary process from good health to poor health to death. Transitions out of good health, the original health state, are assumed to occur of the onset of health problems or death. Once an individual becomes unhealthy, the model assumes that no recovery is possible. These basic assumptions hinder the modeling of a realistic profiles of functioning changes over the life cycle to the extent that recover from poor health occurs (S. Laditka & Hayward, 2003).

The Sullivan method offers many advantages. It is straightforward to apply. Data from cross-sectional studied, which are less costly and more readily available than panel surveys, can be use to estimate the model. Many countries have cross-sectional surveys in place, which provide regular estimates of population health. Moreover, the sample sizes of these health surveys produce highly reliable estimates of age-specific prevalence rates. Further, prevalence-based methods are less influenced by survey design and analytic strategies than methods relying on longitudinal data (Saito et al., 1999).

Although the Sullivan method will continue to be a popular method of calculating healthy life indices, it has several drawbacks. The method’s assumptions constrain the portrayed of the expected life cycle or functional status histories of persons who are exposed to current mortality and morbidity conditions (S. Laditka & Hayward, 2003). Further, once individuals have experienced a health problem, it does not permit recover. Under conditions in which individuals experience both the onset of health problems and recover, the Sullivan method will yield an inaccurate portrayal of the timing and volume of a cohort’s health experience. The Sullivan method also can produce what appears to be a counter-intuitive relationship between changes in prevalence rates of health status and healthy life expectancy. During periods of rapidly declining mortality, calculation of healthy life based on the Sullivan method remain fairly stable relative to the growth in overall life expectancy (A. C. Bebbington, 1991; Crimmins & Hayward, 1997). This is because the health composition of the population, represented by prevalent rates, is not strongly affected by mortality changes (Crimmins et al., 1994; Crimmins, Saito, & Hayward, 1993; Preston, 1982)carried out a series of simulation exercises using a multistage life table model, demonstrating that falling mortality rates and falling morbidity rates increase the years of healthy life. Falling mortality unaccompanied by falling morbidity, however, led to an increase in the expected years of poor health. The results of Sullivan-based models thus are consistent with a method that take account directly of the underlying dynamics of health (S. Laditka & Hayward, 2003).

2.6.2 The multiple-decrement life table method

The multiple decrement life table method considers not only death but also transition towards definite life-states as decrement events for the cohort of the table. In his model, Jordan (Jordan, 1952) considers death and disability as "absorbing" states. The years-lived before getting disabled in such a multiple decrement life table are equivalent to the years-lived in the life table; while the latter leads to the estimation of life expectancy, the former leads to the estimation of "active" life expectancy expressing the mean duration of life before getting disabled. The model does not allow for the possibility of a return to the initial state (that is, the recovery of lost functions). By using a follow-up survey to assess, between two waves of data collection, the number of transitions from the initial state (active) to the absorbing state (death or disability), it is possible to estimate the age-specific probabilities of survival in the initial active state, to apply this age by age to an hypothetical cohort and construct the active life table of the survey population: at each age, the survivors of the table are active survivors. Being presented with data collected by surveys conducted several times on the same sample, this method produces a period indicator, properly reflecting the current conditions of life and health patterns. The table provides the active life expectancy which is the mean duration of life without entering disability: Among the existing estimation method for health expectancy indicators, the multiple decrement life table presented by Katz et al. provides a period indicator from a relatively limited amount of data and a simple methodology (J. M. Robine et al., 2000). This method has been used in very specific contexts with specific data and therefore there has been no opportunity to either compare properly period conditions over time or to compare the situation from a country to another.

The interest of this method also relies on its calculation of joint probabilities of transition out of the initial health state and into death: therefore, the state based mortality risk is taken into account, unlike when transition probabilities are applied to regular life tables concerning the whole population. Nevertheless, the probabilities of dying are estimated from a limited number of observations (the survey sample) and so are very approximate compared to those from regular life tables (used with the first type of method presented above). Secondly, the indicator derived by this method must be interpreted rigorously, taking into account the fact that any withdrawal from the initial cohort is considered as being definitive. This is due to the structure of the tables which, as we have seen, were originally constructed with specific purposes: a multiple decrement life table was aimed to estimate the number of years spent before entry into one of the states covered by the insurance scheme.

However, it would be of interest for health prevention to construct indicators informing about length of life before the onset of disease, or, in the field of health policy, to evaluate the time between remission and relapse or death (J.M. Robine, Michel, & Branch, 1992). Finally, this method can be used for cases where there is no possible return to the initial state, for instance senile dementia.

2.6.3 The multistage life table method

This methodology was initially devised by actuaries and insurance companies to calculate pensions and contributions on the basis of mean length of life before getting in the insured state, namely, disabled or widowed. In 1952, Jordan described the demographic techniques leading to the construction of multiple decrement tables that could be used in these fields (disability, marital status…) (Jordan, 1952). This method was also used to calculate an active life expectancy, using longitudinal data. (Katz, 1983; Katz, Branch, & Papsidero, 1983)

Increment-decrement life tables were developed to allow transitions of all kinds(Hoem, 1970, 1977; Schoen, 1975). Indeed, in 1970 Fanshel and Bush (Fanshel & Bush, 1970) proposed a health index designed to evaluate the impact of a specific health programme on the health state of a population targeted by this programme. This index led to the development of an increment-decrement (multi-state) life table based on a Markov chain (J. M. Robine et al., 2000).

As originally presented, the table is constructed from a hypothetical cohort of persons of given age belonging to one of the studied states. By observing transitions between states and towards death, one obtains the age specific incidence of transitions for the studied period, and the related transition probabilities. Knowing the age-specific probabilities of remaining in, leaving, re-entering a state or dying, we can distribute the survivors of the initial cohort, age after age, among the considered states. This is the period prevalence associated with these states as a result of the conditions of life and health pattern prevailing during the period. The person-years spent in the states and the corresponding state based health expectancies, for the persons belonging to the initial state cohort.

The increment-decrement life table is ideally constructed from data from registers or flow data produced by longitudinal surveys of at least two waves, conducted on a representative sample of population, so as to encompass all transitions. The index obtained in this way, entirely constructed from incidence rates, is a period index of great precision. Unlike the observed prevalence life table method, the constituent data series of the increment-decrement methods are all "period" data, and data on mortality is assessed status-based allowing estimation of the different risks related to the different health states. The wealth of information makes it possible to simulate, from any age, the distribution of a closed stationary population among the different states, under period conditions, and thence to calculate period health expectancies specific to each state or for the whole population (J. M. Robine et al., 2000).

In theory increment-decrement life tables are so powerful that this method should have supplanted previous ones. However, the lack of appropriate flow data in most countries makes such ‘ideal’ models virtually unusable. Indeed, the various studies published health expectancies use mostly the same material, the only available longitudinal data series: the Establishment of Populations for Epidemiological Studies of the Elderly, the National Long Term Care Survey. These studies usually propose new methods for the estimation of transition probabilities; they are rather theoretical and the calculations provided are sporadic.

To date, they do not permit any regular production of indicators or time series necessary to study trends and make international comparisons. Second, the theoretical models proposed use increasingly sophisticated methods to estimate the transition probabilities, making it possible to handle a great number of variables which might affect the studied transitions (S. B. Laditka & Wolf, 1998; Land, Guralnik, & Blazer, 1994). In this respect, some models have integrated the duration in the different states, as well as the usual demographic and social variables, to estimate the probabilities. The use of longitudinal data also raises some methodological problems. Longitudinal data require complex survey design and the collected data as to be used with caution as regards to the precision of the information on transitions. Furthermore, as transitions are observed in a sample, the estimates are submitted to variability depending on the size of the sample (generally small in the case of longitudinal surveys. Yet when the ultimate goal is appropriate, observed prevalence life tables are often preferable to increment-decrement life tables, since they permit a regular production of indicators from surveys conducted routinely in most developed countries (J.M. Robine et al., 1999).

Deciding which method to use will depend on the aim to be pursued and the data that are available. Broadly, the choice is between a method that gives accuracy but is based on a complex methodology and requires data that are rarely available – multiple-decrement or increment-decrement life tables – and a method that contains more assumptions but is based on a straightforward, robust methodology and requires data that are widely available: observed prevalence life tables. In the latter case, the size of error involved must be weighed against the usefulness of the indicator produced. When only cross-sectional data are available, if the studied phenomenon is sensitive to contextual factors and subject to sharp fluctuations through time, it is a case of deciding whether the information conveyed by the indicator will be relevant enough to proceed with the calculation.

However, health expectancy estimates based on increment-decrement life tables are an important supplement to Sullivan-based estimates: despite their heavy data requirements and more complex modeling, the increment-decrement life tables are a very powerful tool in understanding current mortality and morbidity patterns and their implications (and changes therein) for population health. Therefore, while the observed prevalence life table is preferred most of the time due to its possible direct application in most countries, the collection of longitudinal data and the development of improved methods to produce increment-decrement life tables are largely encouraged (J. M. Robine et al., 2000).

Summary

In the study the author used the prevalence-base life table (the Sullivan Method) applied for calculating ALE. Data from cross-sectional studied, which were less costly and more readily available than panel surveys, can be use to estimate the model. The authors used cross-sectional surveys, which provided regular estimates of population health.

CHAPTER III

RESEARCH METHODOLOGY

This chapter obtained 6 parts. Firstly, morbidity consist of data sources, research design, measurements, and analytical methods for studied trends in age-specific prevalence rates from chronic diseases (hypertension—HT, diabetes—DM) and health parameters (FPG, TC, and BMI). Secondly, disability contained data sources and analytical methods for studied trends in age-specific prevalence rates from activities of daily living disability. Thirdly, mortality comprised data sources, research design, and analytical methods for studied trends in age-specific mortality rates of chronic diseases among the population, the chronic diseases from first 10 leading caused group of death which classified by ICD-10 compose of ischemic heart disease (I20-I25), cerebrovascular disease (I60-I69), and neoplasms (C00-D48). Finally, the active life expectancy for studied trends of the proportion of active life expectancy to life expectancy at age 60 and over contained data sources and analytical methods. Moreover, this chapter also presented ethical considerations.

3.1 Morbidity

3.1.1 Data sources

Data used for these analyses were obtained from the National Health Examination Survey (NHES I and III) in 1992 and 2004. This survey was conducted by Ministry of Public Health (MOPH), and Health Systems Research Institute. These representative national surveys were within the same range as those derived from other countries (Jitapunkul, Kunanusont, Phoolcharoen, Suriyawongpaisal, & Ebrahm, 2003).

3.1.2 Research design

A cross-sectional survey was conducted mainly direct survey from the MOPH, and Health Systems Research Institute. The process of NHES was as follow:

a) The NHES I was conducted between August 1st, 1991 and December 31st, 1991 by MOPH of Thailand. A stratified two-stage random sampling cross-sectional survey based on the 1991 Health and Welfare Survey frame, National Statistical Office (NSO) which included regions and Bangkok metropolitan as the stratum. Each of the stratums was selected blocks and villages from in municipal area, in sanitary areas, and non municipal-sanitary areas at the first stage sample. Household members were as the secondary stage sample by systemic random sampling. The population sample of the study (≥15 years) was 15,123 participants. The final collected sample as a percentage of the target sample size, after selection of replacement individuals, by geographic region was as follow: Central, 18.2%; Northeast, 35.2%; North, 17.5%; South, 19.7%; and Bangkok, 9.4%.The proportion of the Thai population that is urban and rural were 44.1% and l 55.8% respectively.

b) The NHES III was conducted, during January 15th, 2004 to April 15th, 2004, by the Health Systems Research Institute and Ministry of Public Health. A multistage sampling frame based on government registers was used. For areas except for Bangkok, three provinces were chosen by probability proportional to size (PPS) for each of the 12 health administration areas. At the second stage, nine electoral units or village were selected by PPS from both urban and rural areas for each province. At the final stage, 15 individuals were selected by simple random sampling with replacement from four broad groups (male or female sex and 15-59 or ≥ 60 years of age) for each electoral unit/village. Replacements within a 5-year age range and of the same sex and electoral unit/ village were randomly sampled. For Bangkok, nine electoral units were selected PPS from six geographical zones. The final stage sampling was identical to that for the other provinces. The final collected sample, after selection of replacement individuals, was 39,290 individuals of a target sample size of 42,120 (93.3%). The final collected sample as a percentage of the target sample size, after selection of replacement individuals, by geographic region was as follow: Central, 99.1%; Northeast, 96.5%; North, 92.0%; South, 89.2%; and Bangkok, 72.2%.The proportion of the Thai population that is urban by geographic region was as follow: Central 32.30%; Northeast, 15.0%; North, 20.1%; South, 23.5%; and Bangkok 100.0% (Aekplakorn, Klafter et al., 2007).

3.1.3 Measurements

a) In the NHES I, BP was measured from the right arm after the subject had been sitting for longer than 5 minutes using a standard mercury sphygmomanometer with standard cuff and using korotkoff sounds I and V. Systolic and diastolic blood pressure (SBP, DBP) values were recorded to the nearest 2 mmHg. Three measurements were done at intervals of at least 30 seconds. Average values were used for the report. Body weight and height were measured with subjects wearing light clothing without shoes. BMI was calculated as weight (kg) divided by height squared (m^2).

Fasting blood samples were taken from all study subjects. Participants were asked to fast for 12 hour overnight before the venous blood sample was obtained. Plasma glucose and serum cholesterol levels were measured on the day of the survey at the hospital laboratories in the catchments area. Two experienced technicians from each laboratory were specifically trained in the standardized procedures. The standard solution and control serum were provided by the Department of Medical Sciences of the Ministry of Public Health.

b) In the NHES III, three serial measurements of BP, taken 1 min apart, were made using a mercury sphygmomanometer with participants in the sitting position after 5 min of rest. A cuff size appropriate for the participant's arm was used. Weight and height were measured by a trained technician using standardized procedures and equipment.

Participants were asked to fast for 12 hour overnight before the venous blood sample was obtained. Blood samples were then centrifuged at 1000 g at 25°C for 10 min. Sera were frozen and transferred to a regional university laboratory for analysis of plasma glucose using a hexokinase enzyme method. Serum total cholesterol (TC) was measured using enzymatic methods. All regional laboratories were standardized by a central laboratory at the MOPH. The intra- and inter-assay coefficients of variations for all the laboratory centers were 2–3% for plasma glucose and 3–5% for TC (Aekplakorn et al., 2008).

3.1.4 Analytical Methods

All statistical analyses were performed using statistical program. NHES I and NHES III analysis method to properly weight the sample to be representative and to take into account for complex sampling design was used. All estimates and all comparisons in population sub-group incorporated allowances for the complex survey design. Statistical analysis organized as follow:

a) The NHES I analysis allowed for the complex sampling design, using the statistical program enumeration districts were taken as primary sampling unit and weight were the population to sample size ratios for each combination of age, sex, and type of enumeration district registered.

b) The survey dataset of the NHES III was sample weighted against the registered 2004 Thai population by public health administration area, urban/rural area (geographical zone for Bangkok), sex and 5-year age groups up to 75+ years. An analysis appropriate for the complex sampling design was used to account for the public health administration area strata at the first stage, area of residence (urban/rural, geographical zone for Bangkok) strata at the second stage, and province as the primary sampling unit and village/ electoral unit as the secondary sampling unit.

c) The descriptive statistics such as frequency, percentage, mean, and 95% Confidence Intervals (CI) will used to describe prevalence of chronic diseases together with risk factors (DM, HT), and health parameters ((FPG, TC, and BMI). Comparison in trends of age-specific prevalence of chronic diseases (DM, HT) and health parameters (FPG, TC, and BMI) from a and c. Z tests were used to determine statistical significance of difference between two surveys. P-value <0.05 was considered as a statistically significant. Age was categorized by 5 years group (15-19, 20-24, 25-29,….75+ years). The analysis was performed for each age group in men and women separately.

d) To compare the age-standardized prevalence of chronic disease and mean of health parameters between 1992 and 2004. Including comparisons by sex, age, and geographic region were age-standardized to the national population. Prevalence (%) and mean were calculated by using the 2007 national population as a standard population. The calculation methods were:

(a) Calculate age-specific prevalence of chronic diseases and health parameters (prevalence and mean) of population for each year by sex and geographic regions.

(b) Multiply the result from (a) by population for each age group by sex and geographic regions in year 2007. The result will be the expected chronic diseases and health parameters number.

(c) Summation of all the expected chronic diseases and health parameters number by sex and geographic regions.

(d) Divide the sum of expected chronic diseases and health parameters number from (c) by the sum of standardized population number. The result will be age-standardized rate.

3.2 Disability

3.2.1 Data sources

This analysis uses data from Survey of Elderly in Thailand (SET) in 2002 and 2007 conducted by National Statistical Office (NSO). The SET is a cross-sectional survey and nationally representative survey of elderly population. The data was carried out in 2002 and 2007 by conducting a survey among elderly in all provinces. The data was performed over this time by conducting a survey among elderly in all provinces. The survey was conducted on the basis of two stages stratified random sampling which included regions and Bangkok metropolitan as the stratum; block (in municipal area) and villages (in similar areas and non-municipal-sanitary areas) as the first stage sample, and the household members as the second stage sample. The selection was made. There were about 43,447 and 30,427 persons in 2002 and 2007 respectively. The population in the survey covered persons aged 50 and 60 years over in 2002 and 2007 respectively. In this study, the analysis was restricted the population aged 60 years and above, which reduced the number of the sample to 23,838, 30,427 persons in 2002 and 2007, respectively.

The 2002 and 2007 SET in Thailand obtained data on self-reported health. For ADL disabilities, the percentage of proxy answers for 2002 and 2007 SET in Thailand were 26 and 27 percent respectively. After the exclusion of proxy answers, the prevalence of ADL disabilities differed slightly. The survey obtained data on basic activities of daily living such as eating, dressing, toilette and bathing.

3.2.2 Analytical Methods

The study used the statistical program to analyze the data. Statistical analysis organized as follow:

a) Data from SET 2002 and 2007 was adjusted and weight by package of NSO.

b) The descriptive statistics such as frequency, cross-tabulation, percentage, used to describe prevalence of ADL disabilities which was calculated by frequency counting ADLs disabled. The prevalence of ADL disabilities was estimated for each sex and age groups. Comparison in trends of age-specific prevalence rates of ADL disabilities from a and b. Age was categorized by 10 years group (60-69, 70-79, 80-89, 90+ years). The analysis was performed for each age group in men and women separately. Then, trends of ADL disabilities by age group in 2002, and 2007 were compared.

c) To compare the age-standardized ADL disabilities rates between 2000 and 2007. The rates were calculated by using the 2007 national population as a standard population. The calculation methods were:

(a) Calculate age-specific ADL disabilities rates of population for each year by sex and geographic regions, during 2000 to 2007.

(b) Multiply the result from (a) by population for each age group by sex and geographic regions in year 2007. The result will be the expected ADL disabilities number.

(c) Summation of all the expected ADL disabilities number by sex and geographic regions.

(d) Divide the sum of expected ADL disabilities number from (c) by the sum of standardized population number. The result will be age-standardized rate.

3.3 Mortality

3.3.1 Data source

Data used in this study were secondary data during 1998 to 2006. Mortality data derived from Bureau of Health Policy and Planning, Ministry of Public Health (MOPH). Cause of death was classified according to the International Classification of Diseases and Related Health tenth Revision (ICD-10) basis which is the mandatory level of coding for international reporting to the WHO mortality database, it has 21 chapter and 2046 categories of diseases, syndromes, external causes or consequences of the external causes (World Health Organization, 1992). Chronic diseases (ischemic heart disease, cerebrovascular, and cancers) from first 10 leading caused groups of death classified by ICD-10 were analysed.

Process of mortality data

In Thailand all deaths have been required by law to report to local administration Department within 24 hours from the time of death or the time seeing the body (Ministry of Public Health, 2005c). The MOPH has collaborated with

Ministry of Interior and reached agreement on using the civil registration database of the Office of Registration Administration (ORA) in the Department of Provincial Administration (formerly called the local administration Department, Ministry of Interior) (Prasartkul & Vapattanawong, 2006).

When a death is registered at the local registrar office, two copies of that record are sent out by electronic means; one to the central registration centre and the order to the Ministry of Public Health (Prasartkul & Vapattanawong, 2006). Mortality database held by MOPH after the coding for underlying cause of death was done under ICD-10 basis. Over 30% of cause of death not registered and more than 20 % of those registered classified were ill defined

Deaths are classified into 3 types: (a) deaths occurring in hospital (b) deaths of natural cause occurring at home; and (c) deaths of unnatural causes (Prasartkul & Vapattanawong, 2006). Overall, among the total 0.4 million reported deaths in Thailand in 2004, 65% took place outside hospitals and 35% in hospital settings (Tangcharoensathien, Faramnuayphol, Teokul, & Bundhamcharoen, 2006). Of this total, 25% were classified as unnatural death (Tangcharoensathien et al., 2006).

3.3.2 Research design

This study presented a cross-sectional description of trends in age-specific mortality rates of chronic diseases during 1998 to 2006. The age-specific rate is the ratio between the number of cases in five year age group and the residence corresponding group.

3.3.3 Analytical Methods

The process of analysis of the data was organized as follows:

a) Exploration of data quality of chronic diseases during 1998 to 2006. Adjust a small number (about 0.1 percent) of no-defined age groups of chronic diseases during 1998 to 2006 had not reported their age with proportionally distribution to know age population. The proportional distribution is calculated by the following formula:

Proportional distribution by age group = $\frac{P1+P2}{P1}$

Where $P1$ is number of death population by known age group

$P2$ is number death population by no-defined age group

b) Causes of age-specific mortality rates of chronic diseases were compared with this formula:

Causes specific mortality rate by age-specific group = $\frac{D_c}{P_{midyear}} \times 100,000$

Where D_c is number-person of cause specific mortality by age-specific group

$P_{midyear}$ is mid-year population by age-specific group

Mortality data from chronic diseases were classified by sex, age, and cause of death. Age was categorized by 5 years group (0-4, 5-9, 10-14, 15-19, …, 80-84, and 85+ years). The mid–year population (Ministry of Public Health, 2007a) was derived from Bureau of Health Policy and Strategy, Ministry of Public Health. Between 1998 and 2006, five-year age averages of case-specific mortality rates were calculated to identify any particular trends.

c) To compare the age-standardized mortality rates from chronic diseases between 1998 and 2006. The rates were calculated by using the 2007 national population as a standard population. The calculation methods were:

(a) Calculate age-specific mortality rate of population for each year, during 1998 to 2006.

(b) Multiply the result from (a) by population for each age group in year 2007. The result will be the expected deaths number.

(c) Summation of all the expected death number.

(d) Divide the sum of expected death number from (c) by the sum of standardized population number. The result will be age-standardized rate.

3.4 Active life expectancy

3.4.1 Data sources

Disability data source

This analysis used data from Survey of Elderly in Thailand (SET) in 2002 and 2007 conducted by National Statistical Office (NSO). The SET is a cross-sectional survey and nationally representative survey of elderly population. The population in the survey covered persons aged 50 and 60 years over in 2002 and 2007 respectively.

The survey was conducted on the basis of two stages stratified random sampling which included regions and Bangkok metropolitan as the stratum; block (in municipal area) and villages(in similar areas and non-municipal-sanitary areas) as the first stage sample, and the household members as the second stage sample. The selection was made. There were about 43,447 and 30,427 persons in 2002 and 2007 respectively. In this study, the analysis was restricted the population aged 60 years and above, which reduced the number of the sample to 23,838, 30,427 persons in 2002 and 2007 respectively.

Including the 2002 and 2007 SET in Thailand obtained data on self-reported health. For ADL disabilities, the percentage of proxy answers for 2002 and 2007 SET in Thailand were 26 and 27 percent respectively. After the exclusion of proxy answers, the prevalence of ADL disabilities differed slightly. The survey obtained data on basic activities of daily living (eating, dressing, toileting and bathing) was assessed by reports of participants.

3.4.2 Analytical methods

a) The descriptive statistic—percentage used to describe health status in each age-sex group.

b) Prevalence of disabilities (ADLs) was calculated by frequency counting non-disabled, IADLs disabled, and ADLs disabled. The prevalence of disabilities (ADLs) in each state was estimated for each sex and age groups. Age was categorized by 5 years group (60-64, 65-69, 70-74, 75-79, 80-84, and 85+ years). The analysis was performed for each age group in men and women separately. Missing data were dropped out from the analysis.

c) Life table technique and the Sullivan Method were used to calculate the number of years expected to life in each health states for specific age-sex-group. The life table for population in the year 2002 and 2007 were constructed using the life expectancy at birth by sex (years) medium variant from world population prospects: the 2006 revision population database (Population Division of the Development of Economic and Social Affairs of the United Nations Secretariat, 2006) in the same year. The West model life tables were based on mortality experience recorded in populations known to have relatively good statistics.

The calculation life expectancy between 2002 and 2007 based on United Nation estimation (For males E_0 = 63.70 in 2002 and E_0 = 66.50 in 2007, for females E_0 = 74 in 2002 and E_0 =75 in 2007 (see Appendix B). The interpolation regional model life tables (for males selected level 20, 21 in 2002 and level 21, 22 in 2007, for females selected level 22, 23 in 2002 and level 23 in 2007) (see Appendix B) were calculated by using a Population Analysis Spreadsheet (PAS) (U.S Census Bureau, 2008).

Thereafter, to estimate ALE, the first step was the calculation of the person-years of life spent in active or without disability for each age interval by multiplying the ${}_nL_x$ function from life table with the age-specific disability (ADLs) prevalence rate. These person-years in active were summed from age x and older to produce the total person-years in active. The final step was the calculation of ALE by dividing the age-specific total person-years by the age-specific l_x function from the life table. The formula of all above calculation was as follows:

$$ALE(DFLE) = \frac{\sum (1 - {}_n\pi_x)\, {}_nL_x}{l_x}$$

Where ${}_n\pi_x$ is the prevalence rate of disability (ADL) in the age interval (x, x+n)

${}_nl_x$ is the total number of person-years lived in the age interval (x, x+n)

I_x is the number of persons surviving to exact age x

The number of years without disability was obtained by subtracting the number of year with disability from life expectancy. The ratio between ALE and LE were calculated and presented as percentages. Then, trends of percentages of ALE and LE by age group in 2002 and 2007 were compared.

3.5 Ethical consideration

This research was conducted by using the secondary data from NHES (I, II, III), MOPH, as NSO. As individuals were not contacted and their personnel information was also not accessed, particularly, names and places of residence. Therefore, there is no ethical issue related with this research.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter obtained four parts of the results and discussion. Firstly, results and discussion of trends in age-specific of chronic diseases and health parameters among the population age ≥15 year were discussed. Secondly, trends in the ADL disabilities among age ≥60 year were showed. Thirdly, mortality trends in age-specific of the chronic diseases (ischemic heart disease, cerebrovascular, and cancers) were discussed. Finally, proportion of the active life expectancy to life expectancy among age 60 and over were portrayed.

4.1 Morbidity: Trends of chronic diseases and health parameters in Thailand, 1992 and 2004

4.1.1 Trends in prevalence of hypertension in Thailand, 1992 and 2004

Table1 and 17 displayed the age-specific and age-standardized prevalence of hypertension (BP≥ 140/90 mm/Hg) among Thai population. A difference of prevalence across the two time periods for the population aged 15 and older showed that, overall, hypertension increased between the two surveys by almost 5% in males and 4.3% in females was not significantly different. The percent of hypertension in males showed slightly higher than females.

The prevalence of hypertension increased with age and peaked at age-group 65 and above for males and females. In 2004, the highest prevalence at age 75 and above was 56.60% and 59.40% for males and females, respectively. Most age-specific prevalence for hypertension was higher in males than in females (see also Figure7). Age-specific prevalence rates increased significantly among age groups 55-64 in males and 65-69 in females. After age 75 and over prevalence rates increased significantly in both sexes. The total hypertension prevalence increased at least one-fold in 12 years for both sexes.

Table2 showed the age-specific and age-standardized prevalence for hypertension by geographic region between 1992 and 2004. It was noted all regions (except Bangkok and Central) tended to increase among age group 15 and above for both sexes.

The highest increasing rates were the North increased 10.50% (16.27% VS 26.77%), followed by the South increased 9.26% (9.54% VS 18.80%), and the Northeast increased 8.66% (11.42% VS 20.08%) except Bangkok decreased 1.72% (23.16% VS 21.44%) and the Central decreased 6.11% (30.98% VS 24.87%) in both sexes. However, overall age-standardized prevalence of hypertension showed the North and the Central were highest prevalence when compared with the other regions for both sexes. Prevalence of hypertension increased with age at all regions. And the rate was different by geographic region. In 2004, for males the prevalence of hypertension was highest in the North (28.85%), followed by Central (26.00%), Bangkok (22.03%), Northeast (20.76%), and South (19.58%). For females it was high in the North (24.82%), followed by Central (23.21%), Bangkok (22.03%), Northeast (19.43%), and South (18.07%) (see also Figure6).

Discussion

Prevalence of hypertension among aged 15 and over would increase by 4.51 % for both sexes between 1992 and 2004, although total diiference of hypertension was not statistically significant. Possible explanations for incline would (a) increase levels of FPG, TC, BMI (b) the adults who were unaware that they have prehypertension or hypertension (Aekplakorn et al., 2008). Hypertension was higher in males compared to females. Consistent with other studies (Grotto, Grossman, Huerta, & Sharabi, 2006; Sun et al., 2007; Wang & Wang, 2004), the prevalence of prehypertension was found to be higher among men than women across all age groups. The reason for this difference remains unclear.

Particularly, the prevalence of hypertension increased with age as expected.Changes in hypertension was clearer for the older than the younger generations. This is because hypertension tends to become hypertensive as they get older. More worrying is the fact that a large proportion of the elderly remain unaware they have hypertension (Aekplakorn et al., 2008) and cardiovascular disease is rapidly becoming an important factor in Thailand. Including, proportion of the population aged 60 years or over is expected approximately to double in 2020 (Aekplakorn et al., 2008). If so, the number of hypertension will increase more expected.

Besides, hypertension is spread relatively consistently throughout the country. The difference was observed between 1992 and 2004, a higher difference of prevalence of hypertension was observed in the South region as a whole tended to have the lowest rates with Bangkok having the highest, Indicating, (a) resulting from change in life style, socio-economic condition, and industrial development (b) there might have inequities in access to, or uptake of, screening and preventive services for non-communicable disease (Aekplakorn et al., 2008). These finding are important for health service planning. Including, appropriate treatment regimens, availability of drugs, and efficient patient education are all important determinants of drug compliance that should be closely monitored to achieve a better BP control rate (Krousel-Wood, Thomas, Muntner, & Morisky, 2004; Van Wijk, Klungel, Heerdink,

& de Boer, 2004). However, extending the duration of disease is possible by preventing death from complications and delaying the progression rate. It means causes disability more often than death which patients frequently require long hospital stays followed by ongoing support in the hospital, or nursing home care. These finding are important for health service planning, particularly the prevalence of the condition becomes more uniformly distributed throughout Thailand. According to it was likely that increasingly more uniform dietary and lifestyle patterns were responsible for this observation, inequities in access to, or uptake of, screening and preventive services for non-communicable disease (Aekplakorn et al., 2008).

Death and disability from coronary heart disease and cerebrovascular disease seem to increase so quickly over this time. Particularly, hypertension is projected that death and disability from coronary heart disease and cerebrovascular disease are now increasing so quickly in these parts of the world that they will rank as first and fourth, respectively, among the causes of the global burden of disease by 2020.

Although our results cannot provide an explanation for the mechanisms underlying smoking, socioeconomic factors, and other factors differences observed, one of the biggest challenges facing public health authorities and medical practitioners is the control of hypertension. In 2006, the Thai ministry of Public Health established goals that 60% of Thai adults age≥40 years should have their blood measured, 70% of those with hypertension should be aware of their condition and 50% of those with hypertension should have their blood pressure control. It seems difficult to meet this goal, hypertension prevention and control helps people to live longer and healthier lives. Thailand should increase its effort in controlling and reducing the hypertension risk factors such as alcohol drinking, being overweight, as well as non-optimum levels of fasting plasma glucose and cholesterol by promoting healthy behaviors such as physical activity and healthy diets.

Especially, health promotion policies are an attempt to produce healthy behaviors that are likely to be sustained. Encourage the scientific community to join in the efforts to create more responsible solutions for epidemic at the societal level. Developing and implementing policies that support environmental changes related to nutrition and physical activity, including a dramatic scaleup of screening services of improvements in hypertension treatment and control.

Strengths and limitations

A clear strength to the present study is the large sample sized, using the same blood pressure measurement— a mercury sphygmomanometer, the ability to monitor hypertension prevalence and manage at a sub-national level across two surveys. Some limitations of present study shoud be considered, the measurement of blood pressure in the survey might not reflect true prevalence of hypertension due to regression dilusion bias or white-coat hypertension (Verdecchia, Staessen, White, Imai, & O'Brien, 2002). Users should keep in mind that underestimation of hypertension prevalence due to individuals who were taking antihypertensive medications but did not acknowledge taking medications to lower their BP and were normotensive at examination time were classified as normotensives. Also, SBP and DBP mean in NHES I are not available so the the present finding can not show mean of SBP and DBP across to surveys.

Table 1 Trends in age-specific prevalence of hypertension in Thailand, 1992 and 2004

	NHES I (1992)				NHES III (2004)				Difference
Male	%	N	95% CI		%	N	95% CI		(%)
15-19	8.60	43	2.90 -	23.00	6.60	46	4.40 -	9.60	-2.00
20-24	13.60	49	7.60 -	23.20	9.50	60	6.60 -	13.50	-4.10
25-29	9.20	51	4.40 -	18.20	13.10	90	10.10 -	16.80	3.90
30-34	17.40	72	10.00 -	28.50	13.60	158	11.10 -	16.60	-3.80
35-39	19.60	112	13.30 -	27.90	18.60	276	14.70 -	23.10	-1.00
40-44	20.30	119	16.50 -	24.70	24.20	345	21.20 -	27.40	3.90
45-49	26.30	118	18.40 -	36.10	32.10	437	28.70 -	35.80	5.80
50-54	29.80	126	22.90 -	37.70	34.40	462	31.00 -	37.90	4.60
55-59	31.70	118	23.10 -	41.80	43.50	529	39.40 -	47.70	11.80*
60-64	31.50	114	28.10 -	35.10	43.90	1290	40.60 -	47.30	12.40*
65-69	52.50	103	42.80 -	62.00	51.40	1464	48.20 -	54.60	-1.10
70-74	52.10	71	43.50 -	60.60	53.30	1205	50.30 -	56.20	1.20
75+	35.60	50	19.10 -	56.30	56.60	1075	52.70 -	60.40	21.00*
Total	**18.50**	**1146**	**13.20 -**	**25.40**	**23.30**	**7437**	**21.30 -**	**25.40**	**4.80**
Female									
15-19	3.30	27	1.20 -	8.60	3.50	17	1.90 -	6.50	0.20
20-24	7.30	49	3.70 -	13.80	3.70	20	2.10 -	6.30	-3.60
25-29	10.30	69	4.50 -	21.70	4.70	34	3.00 -	7.20	-5.60
30-34	12.40	97	6.20 -	23.30	7.80	88	5.70 -	10.60	-4.60
35-39	12.90	129	8.80 -	18.60	12.00	168	10.20 -	14.20	-0.90
40-44	21.70	159	12.50 -	35.00	22.80	337	19.70 -	26.20	1.10
45-49	28.30	144	23.60 -	33.50	30.00	451	26.10 -	34.30	1.70
50-54	35.10	209	28.40 -	42.50	34.20	564	31.10 -	37.40	-0.90
55-59	33.30	175	24.10 -	43.90	42.00	556	37.70 -	46.40	8.70
60-64	40.70	167	34.70 -	47.00	46.50	1380	43.30 -	49.80	5.80
65-69	39.60	116	32.50 -	47.20	49.90	1512	46.90 -	52.90	10.30*
70-74	54.50	100	37.80 -	70.20	52.70	1276	49.10 -	56.20	-1.80
75+	35.90	89	27.00 -	45.90	59.40	1163	54.90 -	63.70	23.50*
Total	**16.60**	**1530**	**12.00 -**	**22.50**	**20.90**	**7566**	**19.50 -**	**22.30**	**4.30**
Both									
15-19	5.92	70	2.09 -	15.64	5.06	63	3.60 -	7.07	-0.86
20-24	10.51	98	6.36 -	16.89	6.62	80	4.94 -	8.81	-3.89*
25-29	9.76	120	4.59 -	19.55	8.91	124	7.02 -	11.23	-0.85
30-34	14.84	169	8.09 -	25.67	10.68	246	8.77 -	12.95	-4.16
35-39	16.16	241	11.44 -	22.33	15.22	444	12.91 -	17.86	-0.94
40-44	21.03	278	14.69 -	29.16	23.45	682	20.88 -	26.24	2.42
45-49	27.32	262	21.80 -	33.64	31.05	888	28.24 -	34.01	3.73
50-54	32.53	335	26.81 -	38.81	34.28	1026	31.72 -	36.94	1.75
55-59	32.53	293	24.14 -	42.21	42.72	1085	39.14 -	46.39	10.19*
60-64	36.27	281	32.29 -	40.44	45.28	2670	42.51 -	48.08	9.01*
65-69	45.62	219	37.84 -	53.62	50.59	2976	48.09 -	53.09	4.97
70-74	53.45	171	40.72 -	65.75	52.96	2481	50.18 -	55.72	-0.49
75+	35.76	139	24.19 -	49.27	58.20	2238	54.63 -	61.69	22.44*
Total	**17.54**	**2676**	**12.66 -**	**23.80**	**22.05**	**15003**	**20.53 -**	**23.64**	**4.51**

* Significant (P-value < .05)

Table 2 Trends in age-specific prevalence of hypertension by geographic region in Thailand, 1992 and 1994

	NHES I (1992)					NHES 3 (2004)				
Male	**Bangkok**	**Central**	**North**	**Northeast**	**South**	**Bangkok**	**Central**	**North**	**Northeast**	**South**
15-19	–	16.20	0.95	4.46	1.03	14.50	5.80	4.62	8.29	3.79
20-24	7.80	20.70	7.73	5.51	3.00	13.10	8.70	15.05	6.96	9.13
25-29	7.40	12.70	6.04	8.04	2.78	1.90	11.10	16.49	16.18	6.68
30-34	8.20	30.40	7.51	5.84	4.68	11.30	15.60	17.05	12.71	8.49
35-39	10.40	29.80	12.88	10.33	11.10	18.30	18.20	23.89	17.51	14.52
40-44	31.50	28.60	14.44	13.41	9.09	24.70	26.70	28.83	21.64	18.00
45-49	36.40	39.60	17.26	17.67	7.70	23.80	36.20	37.55	28.24	27.49
50-54	47.40	42.50	18.17	18.44	14.87	46.20	39.50	38.20	26.21	35.11
55-59	56.20	47.40	22.78	12.78	18.07	35.10	48.40	49.74	37.82	43.84
60-64	53.80	42.20	22.84	22.91	15.55	35.40	54.40	45.05	36.79	43.75
65-69	57.10	73.50	45.93	30.32	26.43	66.00	59.20	55.47	43.36	43.34
70-74	61.10	69.20	43.89	37.36	27.32	55.10	55.80	58.92	47.72	50.84
75+	55.10	47.70	23.93	24.39	23.12	46.60	63.10	62.55	47.30	55.03
Total	**18.60**	**27.40**	**12.11**	**10.45**	**7.45**	**23.00**	**25.80**	**28.37**	**20.30**	**19.23**
Standardized	**25.17**	**31.99**	**14.55**	**12.11**	**8.87**	**23.40**	**26.00**	**28.85**	**20.76**	**19.58**
Female										
15-19	5.40	5.60	0.94	2.71	–	5.10	4.90	4.42	1.57	4.47
20-24	5.40	11.20	5.40	2.74	1.89	4.40	4.80	1.83	4.98	0.95
25-29	1.60	18.20	3.05	3.20	4.23	3.40	3.40	7.35	5.50	1.80
30-34	5.60	21.30	6.67	6.19	2.27	7.70	8.90	6.75	9.04	3.90
35-39	11.90	18.50	9.90	8.29	5.70	10.90	9.90	14.30	13.68	8.65
40-44	18.20	32.50	14.95	14.12	9.31	12.00	23.70	25.80	23.45	18.26
45-49	24.70	41.60	23.20	13.83	15.62	23.90	33.70	27.93	30.79	26.45
50-54	48.80	48.70	30.09	18.01	18.23	29.20	37.60	39.20	30.57	29.72
55-59	41.90	47.00	29.09	15.99	17.60	34.70	49.30	46.12	38.35	33.58
60-64	36.60	52.70	40.06	21.72	31.35	42.70	54.40	51.81	39.25	43.38
65-69	37.80	54.00	36.47	23.26	20.67	51.40	55.50	57.30	41.65	46.50
70-74	66.70	70.40	55.05	32.85	26.11	60.70	56.00	61.12	40.93	56.94
75+	63.90	38.00	41.02	20.03	32.85	68.10	60.60	63.51	50.88	64.89
Total	**15.10**	**23.90**	**14.07**	**8.68**	**7.66**	**19.10**	**23.50**	**24.03**	**18.72**	**17.54**
Standardized	**21.81**	**30.10**	**17.88**	**10.79**	**10.22**	**19.75**	**23.82**	**24.82**	**19.43**	**18.07**
Both										
15-19	–	10.80	0.95	3.59	0.49	9.80	5.40	4.52	5.00	4.13
20-24	6.60	16.20	6.55	4.12	2.42	8.80	6.80	8.45	5.97	5.07
25-29	4.40	15.50	4.52	5.50	3.55	2.70	7.30	11.93	10.93	4.25
30-34	6.80	25.80	7.07	6.02	3.44	9.40	12.20	11.86	10.89	6.15
35-39	11.20	23.90	11.34	9.28	8.34	14.30	13.90	18.96	15.59	11.54
40-44	24.60	30.60	14.71	13.77	9.20	17.90	25.10	27.28	22.54	18.13
45-49	29.60	40.60	20.27	15.77	11.68	23.80	34.90	32.59	29.54	26.96
50-54	48.20	45.70	24.53	18.22	16.56	37.00	38.50	38.71	28.45	32.30
55-59	48.80	47.20	26.11	14.41	17.83	34.90	48.90	47.87	38.09	38.48
60-64	44.60	47.70	31.86	22.30	23.54	39.40	54.40	48.56	38.09	43.56
65-69	47.40	63.00	40.85	26.58	23.47	57.80	57.20	56.44	42.43	45.05
70-74	64.10	69.80	50.06	34.92	26.66	58.40	55.90	60.12	43.93	54.17
75+	59.80	41.70	34.10	21.83	28.79	59.90	61.60	63.10	49.37	60.81
Total	**16.80**	**25.60**	**13.12**	**9.55**	**7.56**	**20.90**	**24.60**	**26.15**	**19.50**	**18.36**
Standardized	**23.16**	**30.98**	**16.27**	**11.42**	**9.54**	**21.44**	**24.87**	**26.77**	**20.08**	**18.80**

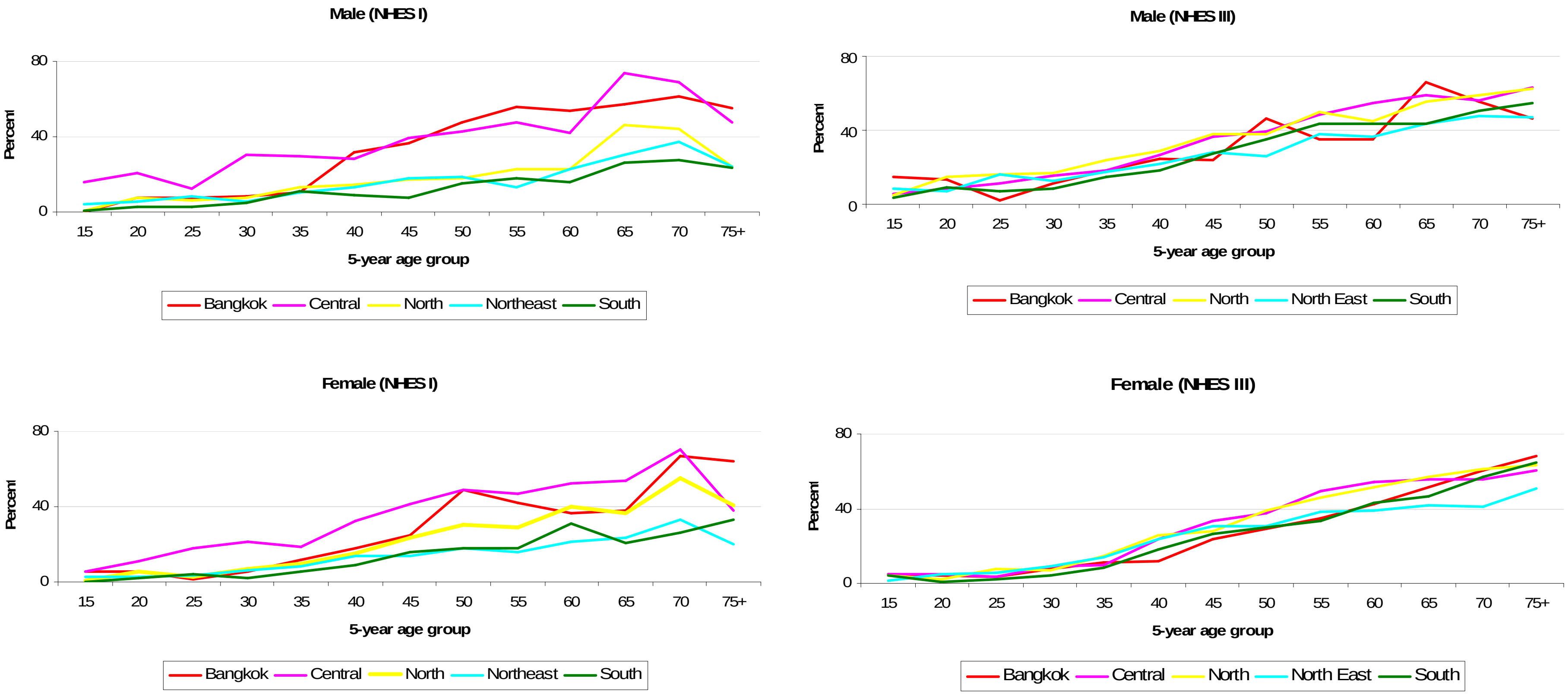


Figure 6 Trends in age-specific prevalence of hypertension by geographic region in Thailand, 1992 and 1994

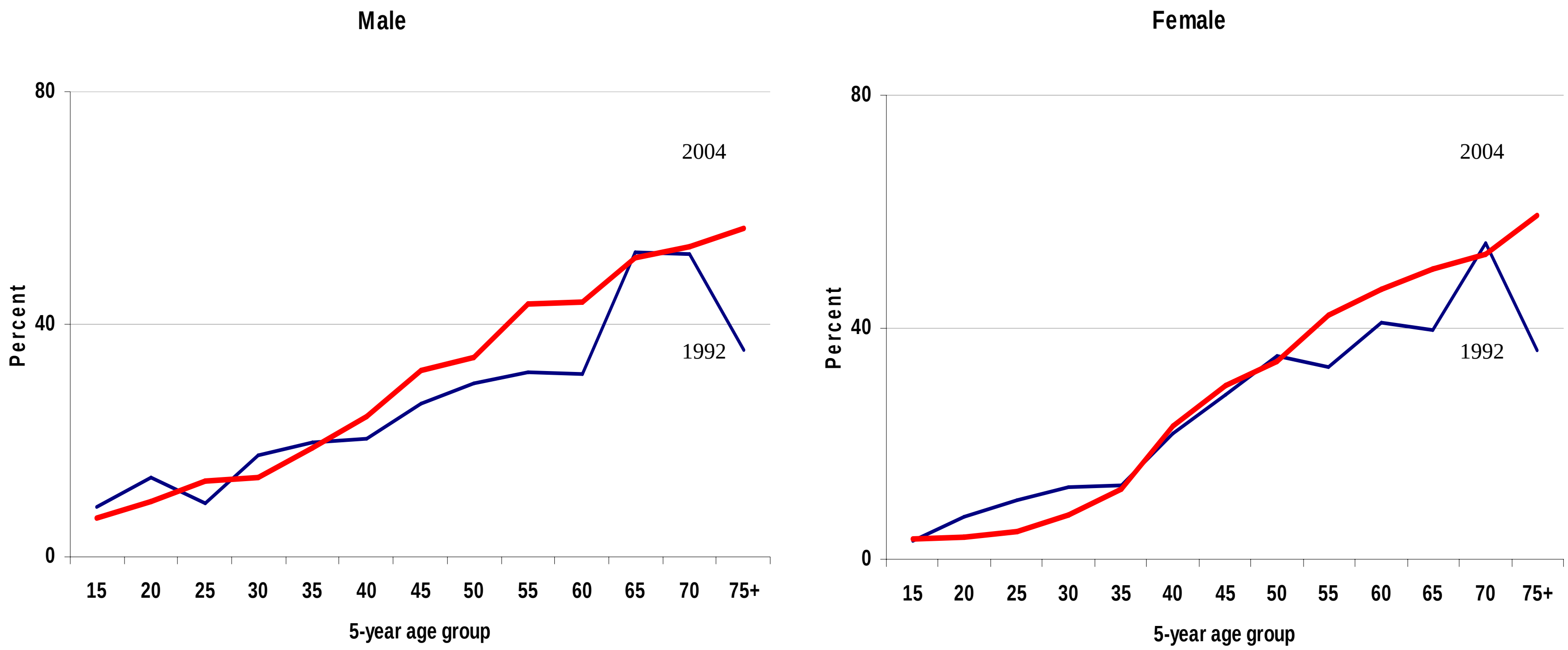


Figure 7 Trends in age-specific prevalence for hypertension in Thailand, 1992 and 2004

4.1.2 Trends in prevalence of diabetes mellitus (DM) in Thailand, 1992 and 2004

Table 2 and 17 displayed the age-specific and age-standardized prevalence of diabetes mellitus (FPG≥ 126 mg/dl) among Thai population. The total differences of age-specific in DM tended to increased 3.1% and 4.3% in 12 years for males and females, respectively. A diiference of prevalence across the two time periods for the population aged 15 and over was statistically significant (P-value<0.05).The age-standardized prevalence of DM also tended to increase between the two surveys by almost 3% in males (from 3.31% to 6.1%) and 4% in females (from 3.82% to 7.46%).

Across each age-group 15-34 during this time, DM showed inconsistent trends for both sexes. It began to increase after age of 35 onwards for males and females (see also Figure9). For each year, prevalence of DM increased with age and peaked at age-group 50-69 for males and females. In 2004, the highest prevalence was 14.80% and 19.60% for males and females, respectively. All age-specific prevalence for DM was higher in females than in males, with the range of 1.20%-19.60% and 1.10%-14.60% respectively.

In sum, the time trends of DM in both sexes between 1992 and 2004 increased almost 1.5 folds in 12 years for both sexes. The percent of DM in males showed higher than females.

Table 4 shows the age-specific and age-standardized prevalence for DM by geographic region between 1992 and 2004. It is noted all regions tend to increasing of DM among age group 35-75+ for both sexes (see also Figure 8). The prevalence of DM was different by geographic region. In 2004, the percent of prevalence by geographic region was highest in Bangkok (9.40%), the Northeast (7.40%), Central

(6.60%), North (6.36%), and South (5.21%) for both sexes respectively. Across age group 35-75+, it is noted Bangkok was highest prevalence of DM when compared with the other regions for both sexes. The prevalence of DM increased with age at all regions. The highest increasing percents of DM by geographic region were: the Northeast 5.10% (2.30% VS 7.40%), followed by North 3.52% (2.84% VS 6.36%), South 2.45% (2.67% VS 5.21%) and Central 2.50% (4.10% VS 6.60%). The prevalence of DM in females was higher than in males

Table 3 Trends in age-specific prevalence of diabetes mellitus (≥126 mg/dl) in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)					Difference
Male	**%**	**N**	**95% CI**			**%**	**N**	**95% CI**			(%)
15-19	1.30	7	0.40	-	4.20	2.10	11	0.80	-	5.20	0.80
20-24	1.70	8	0.40	-	7.40	2.40	12	1.10	-	5.00	0.70
25-29	1.10	9	0.30	-	3.50	1.10	10	0.50	-	2.60	0.00
30-34	2.80	13	1.00	-	7.60	2.50	28	1.60	-	4.10	-0.30
35-39	2.30	12	1.20	-	4.40	5.80	73	4.20	-	7.90	3.50*
40-44	2.50	17	1.10	-	5.30	5.80	72	4.20	-	8.00	3.30*
45-49	3.60	19	1.80	-	6.90	8.30	109	6.50	-	10.50	4.70*
50-54	4.50	21	2.70	-	7.60	11.10	135	9.10	-	13.60	6.60*
55-59	6.70	26	4.50	-	9.90	14.00	169	11.70	-	16.70	7.30*
60-64	10.00	20	5.70	-	16.90	12.50	353	11.10	-	14.00	2.50
65-69	11.40	14	5.40	-	22.50	14.80	405	12.80	-	16.90	3.40
70-74	6.60	9	2.90	-	14.20	12.20	264	10.40	-	14.20	5.60*
75+	1.70	5	0.80	-	3.50	9.70	194	8.00	-	11.60	8.00*
Total	**2.80**	**180**	**1.80**	-	**4.40**	**5.90**	**1835**	**5.00**	-	**7.00**	**3.10***
Female											
15-19	0.20	2	0.10	-	0.80	1.30	5	0.40	-	3.60	1.10
20-24	0.40	8	0.20	-	1.20	1.20	5	0.40	-	3.50	0.80
25-29	0.60	12	0.30	-	0.90	1.90	14	1.10	-	3.40	1.30*
30-34	1.10	17	0.70	-	1.70	2.60	23	1.60	-	4.30	1.50*
35-39	5.30	29	1.70	-	15.60	5.60	71	4.20	-	7.40	0.30
40-44	3.70	29	2.60	-	5.10	6.90	93	5.30	-	9.00	3.20*
45-49	6.90	35	4.20	-	11.10	8.10	119	6.50	-	9.90	1.20
50-54	7.90	44	4.80	-	12.60	13.70	204	11.40	-	16.40	5.80*
55-59	9.20	41	6.60	-	12.50	19.60	236	16.60	-	23.00	10.40*
60-64	2.80	20	1.60	-	5.10	18.70	519	16.90	-	20.70	15.90*
65-69	8.00	27	3.40	-	17.60	18.30	517	16.20	-	20.60	10.30*
70-74	6.80	14	3.90	-	11.30	15.80	389	14.00	-	17.80	9.00*
75+	4.00	11	1.80	-	8.80	11.20	249	9.60	-	13.10	7.20*
Total	**2.90**	**289**	**1.90**	-	**4.20**	**7.20**	**2444**	**6.40**	-	**8.00**	**4.30***
Both											
15-19	0.73	9	0.25	-	2.17	1.66	16	0.73	-	3.75	0.93
20-24	1.09	16	0.29	-	4.05	1.80	17	0.87	-	3.67	0.71
25-29	0.81	21	0.33	-	1.96	1.52	24	0.93	-	2.48	0.71
30-34	1.92	30	0.86	-	4.21	2.57	51	1.72	-	3.82	0.65
35-39	3.84	41	1.46	-	9.74	5.67	144	4.56	-	7.03	1.83
40-44	3.08	46	2.07	-	4.54	6.40	165	5.11	-	7.97	3.32*
45-49	5.22	54	3.75	-	7.23	8.16	228	6.97	-	9.53	2.94*
50-54	6.23	65	3.97	-	9.64	12.50	339	10.89	-	14.30	6.27*
55-59	7.99	67	5.91	-	10.74	17.00	405	15.04	-	19.15	9.01*
60-64	6.27	40	4.21	-	9.23	15.79	872	14.57	-	17.10	9.52*
65-69	9.62	41	6.32	-	14.37	16.69	922	14.95	-	18.59	7.07*
70-74	6.67	23	4.04	-	10.79	14.21	653	12.74	-	15.81	7.54*
75+	3.05	16	1.63	-	5.63	10.58	443	9.39	-	11.90	7.53*
Total	**2.84**	**469**	**1.92**	-	**4.19**	**6.57**	**4279**	**5.79**	-	**7.46**	**3.73***

* Significant (P-value<.05)

Table 4 Trends in age-specific prevalence of diabetes mellitus (FPG≥126 mg/dl) by geographic region in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)				
Male	**Bangkok**	**Central**	**North**	**Northeast**	**South**	**Bangkok**	**Central**	**North**	**Northeast**	**South**
15-19	-	1.59	0.00	0.76	2.41	3.00	0.60	1.38	3.46	1.44
20-24	-	2.08	0.84	2.09	0.29	-	2.20	0.75	4.28	-
25-29	-	-	-	2.45	4.13	3.20	1.80	0.57	1.10	-
30-34	-	3.28	-	0.80	5.78	-	3.10	1.87	2.87	1.98
35-39	-	3.08	1.49	-	3.87	11.70	5.20	7.48	4.85	5.25
40-44	-	1.69	2.98	-	2.00	9.50	4.20	5.87	7.24	3.89
45-49	-	4.65	1.94	2.51	3.67	6.60	9.10	9.65	7.03	7.66
50-54	-	6.90	-	4.67	2.58	26.90	11.60	8.45	10.89	9.65
55-59	-	8.72	1.92	8.64	5.23	27.10	15.20	9.35	14.78	12.43
60-64	-	16.55	3.58	3.93	7.83	21.00	15.50	8.37	13.20	8.07
65-69	-	18.42	2.91	5.76	10.01	25.10	16.50	13.21	12.77	15.86
70-74	-	6.80	13.48	2.56	1.58	26.10	13.80	8.97	13.57	8.07
75+	-	0.71	-	6.59	0.92	12.00	8.60	7.67	11.83	9.93
Total	-	**3.33**	**1.36**	**2.36**	**3.48**	**10.00**	**6.10**	**5.39**	**6.14**	**4.48**
Standardized	-	**4.18**	**1.64**	**2.66**	**3.49**	**10.22**	**6.24**	**5.51**	**6.32**	**4.60**
Female										
15-19	-	0.00	-	0.36	0.97	-	0.70	1.49	2.09	-
20-24	-	0.23	-	0.62	0.46	-	1.30	1.74	1.52	-
25-29	-	0.39	0.52	0.73	0.97	3.30	2.70	2.25	1.04	2.09
30-34	-	0.21	1.65	1.55	2.35	1.50	1.50	3.61	3.48	1.14
35-39	-	6.97	4.31	1.62	6.31	7.80	4.50	3.43	7.33	6.00
40-44	-	4.15	2.95	3.01	3.98	8.10	5.20	6.97	8.06	7.22
45-49	-	6.98	7.43	6.41	6.64	5.30	8.20	7.18	9.45	6.51
50-54	-	9.39	5.25	8.78	5.19	14.50	11.20	13.23	17.46	9.55
55-59	-	14.17	1.94	7.09	6.91	21.10	15.80	20.61	23.47	13.49
60-64	-	0.18	4.81	3.54	7.19	18.10	19.50	14.14	21.46	16.80
65-69	-	5.93	17.92	4.00	5.58	24.00	19.90	15.60	19.76	13.96
70-74	-	5.98	10.52	6.19	4.74	27.40	18.40	12.53	14.38	16.69
75+	-	0.35	7.54	8.60	4.78	25.70	11.30	7.93	12.51	10.38
Total	-	**2.85**	**3.10**	**2.53**	**3.09**	**8.50**	**6.80**	**6.85**	**8.04**	**5.63**
Standardized	-	**4.03**	**4.01**	**3.21**	**3.72**	**8.86**	**6.95**	**7.18**	**8.45**	**5.77**
Both										
15-19	-	0.77	-	0.56	1.64	1.30	0.70	1.43	2.78	0.73
20-24	-	1.22	-	1.35	0.38	-	1.80	1.27	2.89	-
25-29	-	0.19	0.27	1.54	2.47	-	2.20	1.40	1.07	-
30-34	-	1.73	1.43	1.18	4.00	0.80	2.30	2.75	3.18	1.54
35-39	-	5.08	2.96	0.84	5.10	9.70	4.80	5.37	6.08	5.63
40-44	-	2.95	2.97	3.47	3.01	8.70	4.70	6.44	7.65	5.67
45-49	-	5.83	4.68	4.44	5.17	5.80	8.60	8.35	8.29	7.07
50-54	-	8.16	2.72	6.80	3.91	20.20	11.40	10.93	14.25	9.60
55-59	-	11.60	1.93	7.85	6.09	23.80	15.50	15.26	19.35	13.01
60-64	-	7.94	4.23	3.73	7.51	19.50	17.60	11.40	17.59	12.69
65-69	-	11.71	10.80	4.83	7.81	24.40	18.30	14.46	16.59	14.78
70-74	-	6.35	11.89	4.54	3.27	26.90	16.40	10.91	14.03	12.88
75+	-	0.50	4.04	7.81	3.31	20.20	10.20	7.82	12.23	10.19
Total	-	**3.09**	**2.25**	**2.44**	**3.27**	**9.20**	**6.50**	**6.14**	**7.11**	**5.08**
Standardized	-	**4.10**	**2.84**	**2.30**	**2.67**	**9.47**	**6.60**	**6.36**	**7.40**	**5.21**

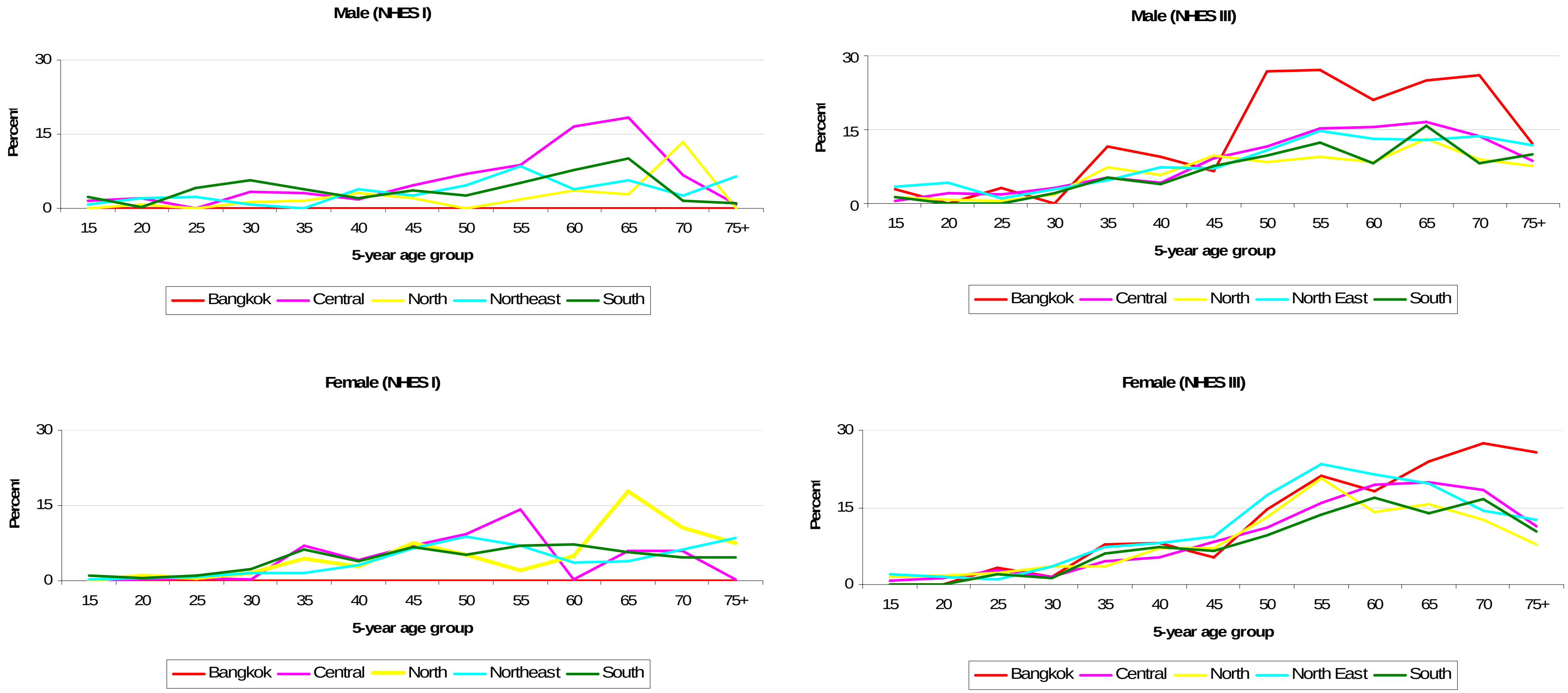


Figure 8Trends in age-specific prevalence of diabetes mellitus by geographic region in Thailand, 1992 and 2004

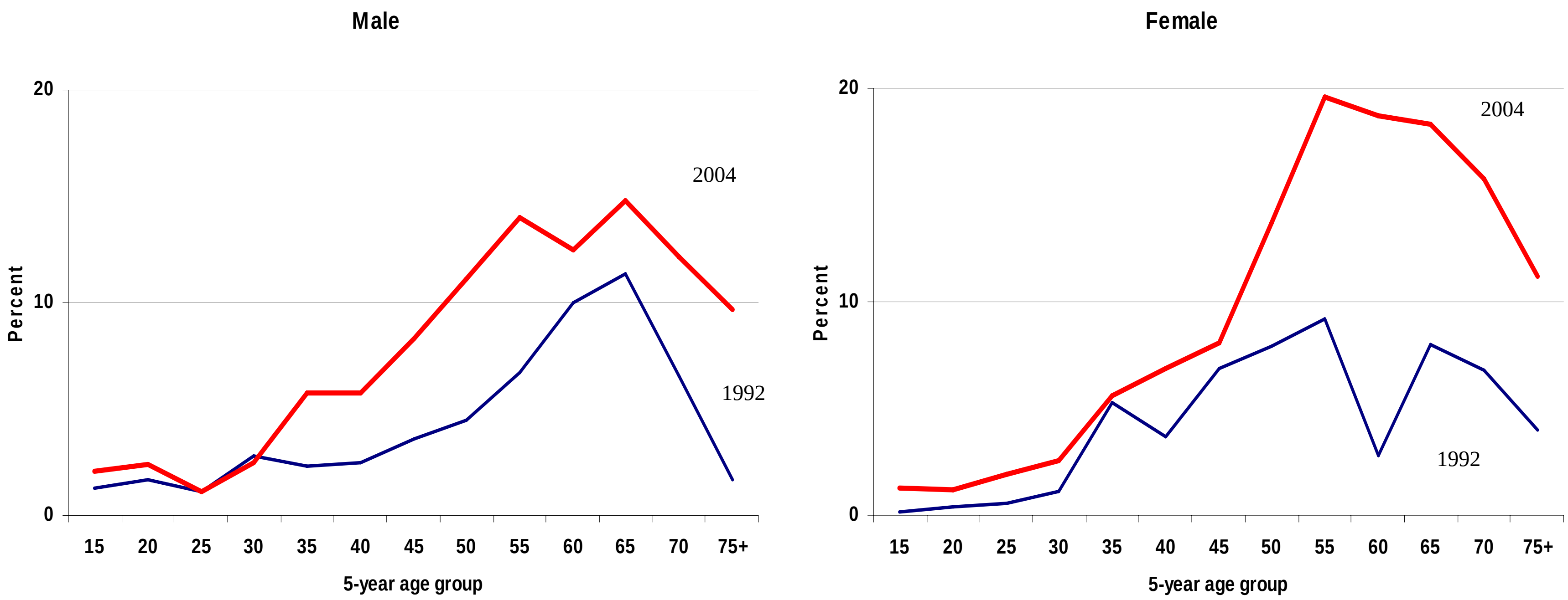


Figure 9 Trends in age-specific prevalence of diabetes mellitus in Thailand, 1992 and 2004

4.1.3 Trends in mean of fasting plasma glucose (FPG) in Thailand, 1992 and 2004

Table 5 and 17 displayed trends in age-specific and age-standardized mean of FPG among Thai population between NHES II (1992) and NHES III (2004). Overall age-standardized mean of FPG tended to increase between the two surveys by almost 8 mg/dl in males (86.75 mg/dl VS 94.98 mg/dl) and 6 mg/dl in females (87.34 mg/dl VS 93.30 mg/dl). Across each age-group 15 to 75 and above mean of FPG tended to increase for males and females (see also Figure11). A diiference of mean across the two time periods for the population aged 15 and over was statistically significant ($P<0.05$). For each year, age-specific mean of FPG increased with age for males and females. In 2004, the highest mean of FPG was 104.69 mg/dl and 105.86 mg/dl for males and females respectively.

Thus, the mean tended to increase for both sexes at the same period. The mean of FPG in males was not different from females. The total mean of FPG increased at least 7 mg/dl in 12 years for both sexes.

Table 6 and Figure 10 showed the trends in age-specific and age-standardized mean of FPG among Thai population aged ≥ 15 years by geographic region at the same period. Overall, the age-standardized mean increased in all regions—the Central 3.62 mg/dl (90.50 mg/dl VS 94.12 mg/dl), North 8.62 mg/dl (84.10 mg/dl VS 92.72 mg/dl), Northeast 11.31 mg/dl (83.18 mg/dl VS 94.49 mmHg), and South 8.36 mg/dl (84.84 mg/dl VS 93.20 mg/dl) for both sexes. In 2004, the mean of FPG was high in Bangkok (100.01 mg/dl), Northeast (94.49 mg/dl), Central (94.12 mg/dl), South (93.20 mg/dl), and North (92.72 mg/dl) respectively. Across each age-group 15 to 75 and above, all regions, the mean of FPG increased with age for both sexes, it peaked after age-group 50 and above for males and females. All regions show the total means of FPP by geographic region almost 2 –fold in 12 years for both sexes.

Table 5 Mean in age specific fasting plasma glucose in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)					Difference
Male	**Mean**	**N**	**95% CI**			**Mean**	**N**	**95% CI**			**(mg/dl)**
15-19	84.61	620	83.39	-	85.83	87.94	650	85.76	-	90.12	3.33*
20-24	84.19	523	82.23	-	86.15	87.8	631	85.41	-	90.18	3.61*
25-29	83.69	534	81.5	-	85.88	88.56	715	86.94	-	90.19	4.87*
30-34	85.04	639	82.7	-	87.38	91.19	965	89.35	-	93.03	6.15*
35-39	86.97	635	83.55	-	90.4	95.3	1230	92.85	-	97.74	8.33*
40-44	86.59	540	84.12	-	89.05	96.71	1250	93.84	-	99.58	10.12*
45-49	87.01	455	83.83	-	90.19	98.29	1198	96.07	-	100.51	11.28*
50-54	87.78	418	83.29	-	92.27	103.72	1118	100.62	-	106.82	15.94*
55-59	88.99	357	85.97	-	92.01	104.69	1064	101.1	-	108.28	15.70*
60-64	95.48	317	85.01	-	105.94	102.21	2490	100.31	-	104.12	6.73
65-69	92.8	210	90.62	-	94.97	103.56	2558	101.38	-	105.75	10.76*
70-74	94.75	130	83.71	-	105.79	101.3	2052	99.04	-	103.56	6.55
75+	88.23	129	81.43	-	95.02	99.97	1781	97.76	-	102.17	11.74*
Total	**86.08**	**5507**	**84.28**	**-**	**87.89**	**94.73**	**17702**	**93.12**	**-**	**96.34**	**8.65***
Female											
15-19	81.98	824	80.82	-	83.14	84.62	1524	83.08	-	86.16	2.64*
20-24	80.51	887	78.26	-	82.76	83.83	1482	81.27	-	86.39	3.32*
25-29	81.65	1035	78.43	-	84.88	84.95	1646	83.26	-	86.64	3.30*
30-34	83.84	1067	81.34	-	86.35	87.38	1792	85.39	-	89.37	3.54*
35-39	87.16	991	83.66	-	90.65	92.06	1711	89.8	-	94.31	4.90*
40-44	87.19	829	84.5	-	89.87	93.74	1426	91.42	-	96.06	6.55*
45-49	93.1	633	89.82	-	96.38	96.26	1127	94.23	-	98.29	3.16*
50-54	93.08	618	88.51	-	97.65	103.38	1082	100.52	-	106.24	10.30*
55-59	96.42	555	91.21	-	101.64	106.08	953	102.84	-	109.33	9.66*
60-64	88.45	456	85.68	-	91.22	105.86	823	103.78	-	107.95	17.41*
65-69	95.28	314	87.59	-	102.98	104.52	550	102.11	-	106.93	9.24*
70-74	92.64	200	86.08	-	99.2	103.55	348	101.2	-	105.9	10.91*
75+	90.56	214	85.72	-	95.39	99.23	360	97.41	-	101.05	8.67*
Total	**84.28**	**7346**	**85.67**	**-**	**87.89**	**92.91**	**19343**	**91.54**	**-**	**94.28**	**8.63***
Both											
15-19	83.27	1344	82.16	-	84.38	86.29	1149	84.67	-	87.91	3.02*
20-24	82.38	1282	81.2	-	83.57	85.8	1155	83.61	-	87.99	3.42*
25-29	82.65	1409	80.1	-	85.21	86.74	1438	85.39	-	88.1	4.09*
30-34	84.43	1528	82.14	-	86.71	89.25	2100	87.57	-	90.92	4.82*
35-39	87.07	1482	84.29	-	89.85	93.64	2564	91.73	-	95.55	6.57*
40-44	86.89	1239	84.62	-	89.16	95.18	2756	93.09	-	97.26	8.29*
45-49	90.07	996	87.85	-	92.28	97.22	2646	95.49	-	98.95	7.15*
50-54	90.49	936	86.59	-	94.38	103.54	2604	101.4	-	105.69	13.05*
55-59	92.86	841	89.15	-	96.56	105.43	2268	102.59	-	108.27	12.57*
60-64	91.81	700	85.82	-	97.8	104.15	5153	102.53	-	105.78	12.34*
65-69	94.11	473	90.07	-	98.14	104.09	5303	102.11	-	106.06	9.98*
70-74	93.6	306	88.05	-	99.15	102.56	4265	100.73	-	104.39	8.96*
75+	89.59	317	85.2	-	93.98	99.53	3644	97.98	-	101.09	9.94*
Total	**85.87**	**12853**	**84.11**	**-**	**87.63**	**93.79**	**37045**	**92.35**	**-**	**95.22**	**7.92***

* Significant (P-value <.05)

Table 6 Mean in age specific fasting plasma glucose by geographic region in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)				
Male	Bangkok	Central	North	Northeast	South	Bangkok	Central	North	Northeast	South
15-19	-	88.51	80.65	81.71	81.11	89.14	87.15	87.13	89.47	86.13
20-24	-	86.26	81.75	81.96	80.16	86.92	87.29	86.54	89.67	85.33
25-29	-	85.55	79.64	81.72	83.87	89.37	89.16	86.56	89.99	85.59
30-34	-	88.72	80.11	80.65	84.99	91.60	92.58	90.64	90.54	91.10
35-39	-	91.06	81.00	80.65	89.79	103.86	94.91	95.56	94.44	95.85
40-44	-	89.05	85.21	83.57	85.47	100.93	95.28	94.23	98.62	97.63
45-49	-	91.32	82.33	83.00	85.37	100.76	99.27	98.31	95.91	102.22
50-54	-	92.68	80.31	85.36	85.03	133.44	105.08	100.95	101.09	101.93
55-59	-	92.63	82.62	87.95	89.00	119.08	104.81	99.84	105.33	105.89
60-64	-	103.73	91.02	84.83	91.38	113.08	105.01	98.26	102.61	98.18
65-69	-	98.14	87.14	87.48	92.03	115.20	104.14	101.55	102.87	104.32
70-74	-	103.79	94.94	85.40	80.34	112.14	103.01	97.11	102.76	99.45
75+	-	87.14	82.06	100.56	85.09	107.76	97.48	98.10	101.87	102.49
Total	-	**89.27**	**82.06**	**82.77**	**84.68**	**101.49**	**95.05**	**93.58**	**94.76**	**93.78**
Standardized	-	**90.41**	**82.52**	**83.23**	**85.00**	**101.81**	**95.24**	**93.78**	**95.02**	**94.04**
Female										
15-19	-	85.70	77.43	78.65	79.73	82.71	82.71	87.13	85.59	82.33
20-24	-	82.66	79.17	78.33	77.00	83.52	81.98	85.16	84.56	83.20
25-29	-	84.11	78.78	79.11	80.09	95.08	85.55	83.39	84.26	85.10
30-34	-	86.89	81.14	80.95	81.58	89.28	86.36	88.08	88.02	85.92
35-39	-	91.21	84.54	81.74	85.09	96.92	90.39	87.32	94.96	93.76
40-44	-	89.96	86.43	82.64	86.26	98.78	92.71	93.72	93.82	93.91
45-49	-	96.02	91.58	89.38	91.26	98.87	96.96	93.39	96.94	97.53
50-54	-	96.79	90.19	89.70	90.13	109.15	102.94	97.00	107.50	102.45
55-59	-	106.48	84.79	88.84	92.43	115.67	105.29	104.40	108.02	100.67
60-64	-	88.46	88.57	84.54	93.42	110.04	109.49	99.84	105.73	107.06
65-69	-	94.57	110.06	86.00	88.00	107.93	107.97	98.11	104.57	106.56
70-74	-	96.85	91.06	88.50	87.38	116.71	105.75	98.50	103.78	103.88
75+	-	91.02	90.92	89.89	89.62	115.13	98.39	94.88	101.03	100.38
Total	-	**88.59**	**83.87**	**82.06**	**83.38**	**98.03**	**92.84**	**91.40**	**93.46**	**92.22**
Standardized	-	**90.25**	**85.67**	**83.19**	**84.77**	**98.55**	**92.42**	**91.74**	**94.00**	**92.45**
Both										
15-19	-	87.07	79.08	80.18	80.38	85.52	84.95	87.13	87.53	84.29
20-24	-	84.58	80.42	80.14	78.42	85.20	84.73	85.83	87.09	84.21
25-29	-	84.83	79.20	80.33	81.89	92.17	87.36	84.98	87.08	85.34
30-34	-	87.79	80.63	80.81	83.22	90.34	89.38	89.34	89.27	88.41
35-39	-	91.13	82.85	81.21	87.42	100.18	92.55	91.27	94.70	94.79
40-44	-	89.51	85.83	83.11	85.87	99.73	93.95	93.96	96.22	95.64
45-49	-	93.69	86.95	86.16	88.34	99.67	98.04	95.71	96.45	99.81
50-54	-	94.76	85.43	87.60	87.64	120.41	103.94	98.90	104.37	102.22
55-59	-	99.94	83.74	88.40	90.75	117.20	105.07	102.24	106.74	103.07
60-64	-	95.70	89.73	84.68	92.43	111.45	107.42	99.09	104.27	102.88
65-69	-	96.22	99.19	86.70	90.03	110.93	106.21	99.74	103.80	105.59
70-74	-	99.96	92.86	87.10	84.10	114.80	104.54	97.87	103.33	101.93
75+	-	89.41	86.81	94.11	87.89	112.17	98.02	96.27	101.39	101.26
Total	-	**88.93**	**82.99**	**82.41**	**84.00**	**99.61**	**93.90**	**92.45**	**94.09**	**92.96**
Standardized	-	**90.50**	**84.10**	**83.18**	**84.84**	**100.01**	**94.12**	**92.72**	**94.49**	**93.20**

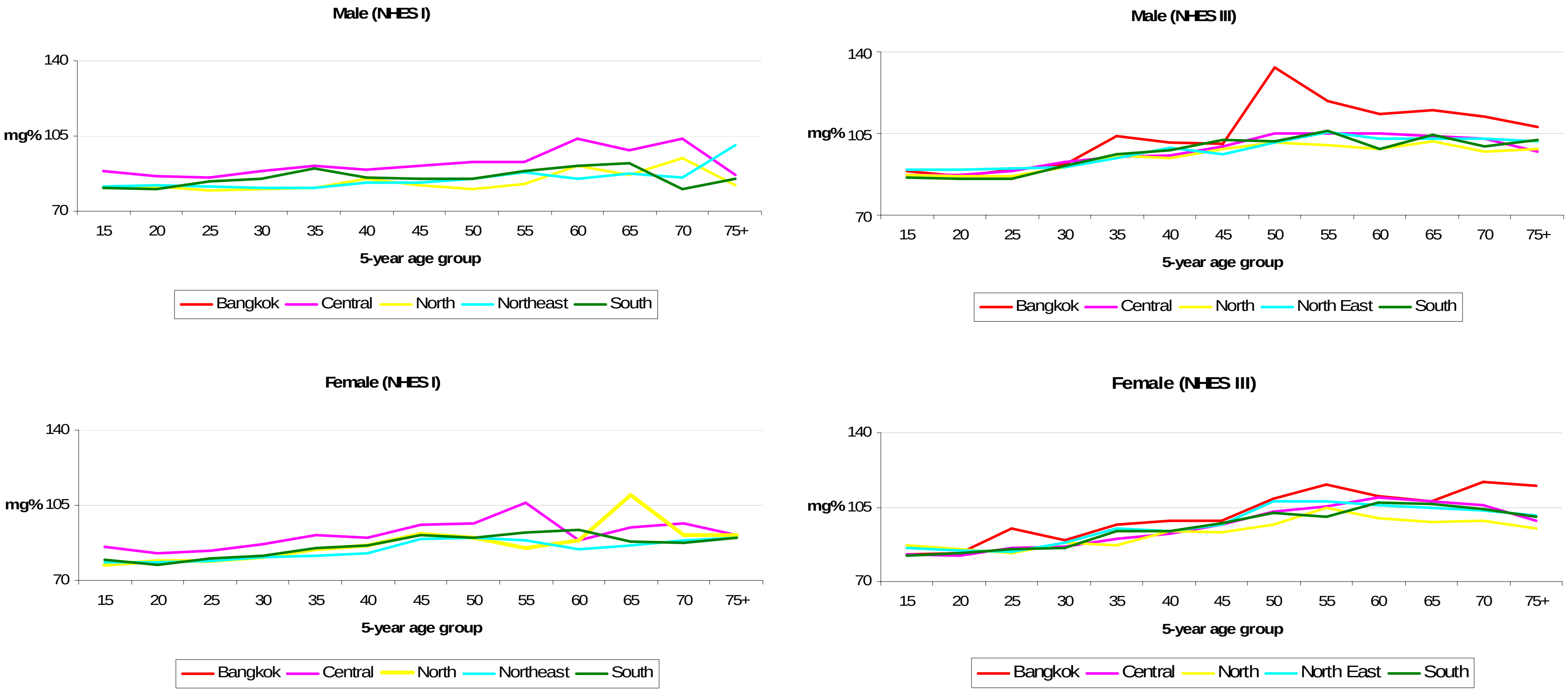


Figure 10 Mean in age-specific of fasting plasma glucose by geographic region in Thailand, 1992 and 2004

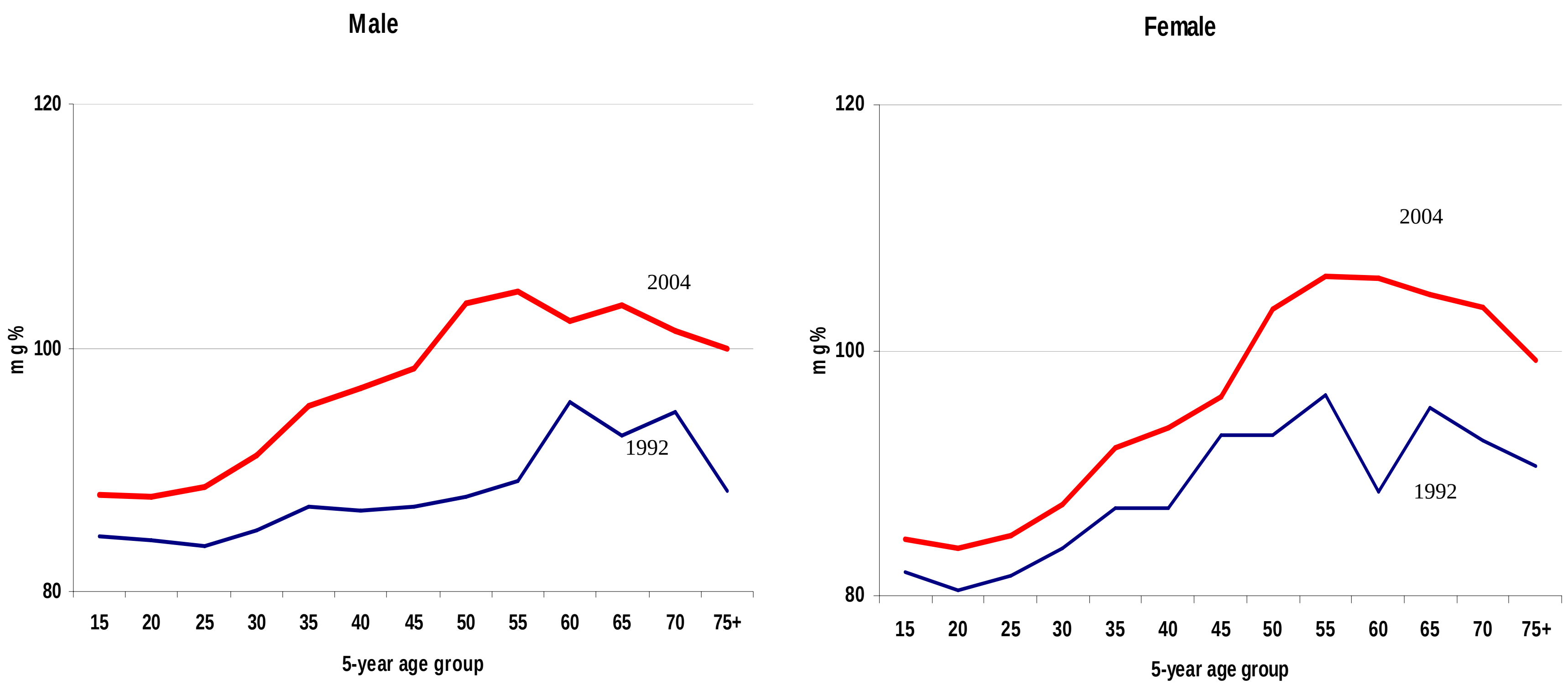


Figure 11 Mean in age-specific of fasting plasma glucose in Thailand, 1992 and 2004

Discussion

Overall, age specific and age-standardized DM (FPG≥126 mg/dl) prevalence and mean FPG tended to increase in both sexes. The time trends of selected DM and FPG look similarly but the rates in females showed higher than males. In this study, the finding indicated that Thai elderly had a higher prevalence of DM and FPG. Diabetes frequently affects the population aged 45 years and over. The finding confirmed as risk of this complication increased with age and appeared as early as the age of 40 years, until the age of 60 years ond over. A diiference across the two time periods for the population aged 15 and over was statistically significant ($P<0.05$).

One explanation is the cause of the increase in diabetes prevalence is likely related to changes in obesity and lifestyle. Especially, obesity and weight gain are leading risk factors for the development of diabetes. It is clearly to the prevalence of overweight and obesity among children and adolescents has also increased dramatically during this period. Including Thai population would be excessive consumption of caloric sweeteners and large amounts of soft drinks and fruit drinks; however, this is certainly not the case (Ministry of Public Health, 2005b). Teenagers prefer western foods to local or Thai food (Ministry of Public Health, 2005d). Technological shifts have reduced physical activity at work, travel, home production, and leisure. Its effect might increase risk of type 2 diabetes. Agree with two major concerns are that much of this increase in diabetes will occur in developing countries, due to population growth, ageing, unhealthy diets, obesity and sedentary lifestyles, and that there is a growing incidence of Type 2 diabetes which accounts for about 90% of all cases at a younger age (Puska, Sepulveda, & Porter, 2003).

Another explanation might be due to an increasing age of the population (Oxfordshire Community Stroke Project, 1983; Robins & Baum, 1981) because increasing risk are higher percent after age 60 or above (World health Organization, 2005). The proportion of the population aged 60 years or over is expected approximately to double in 2020 (Aekplakorn et al., 2008). If so, the number of diabetes will be increase that the majority will be in the 45-64 year age bracket and affected in their most productive years.

Moreover, diabetes is a chronic disease, leading to considerable morbidity and premature mortality (Amos, McCarty, & Zimmet, 1997; Kannel & McGee, 1979). This finding also shows a high prevalence of diabetes across all regions of Thailand with low levels of diagnosis and appropriate management of blood glucose. However, without increased efforts to prevent diabetes by promoting and facilitating healthier lifestyles along with improvements in the diagnosis and control of diabetes and associated risk factors, the health burden of diabetes has the potential to overwhelm the health care system.(Aekplakorn et al., 2003). As such, increasing the proportion of diabetes that is diagnosed, perhaps through opportunistic screening of high-risk individuals, might be an appropriate and relatively low cost means of addressing the growing diabetes-related disease burden in Thailand. Protective is more convincing than the evidence for several other nutrients which have been implicated.

Strenght and limitations

Several limitations should be considered. Although replacements were made based on age, sex and cluster, in formation to determine the response rate before replacement was not available and differentials in the final collection rate may also obscure variation across two survey and geographic regions. Oral glucose tolerance tests were not conducted across two surveys, preventing and estimation of the exact prevalence of pre-diabetes. Long-term glycemic control could also not be assessed as AIC was not measured. Also, no sample in Bangkok for blood test are not available in

NHES I. Despite these limitations, a clear strength of the study is the large sample size and the ability to monitor diabetes prevalence and management at a subnational level (Aekplakorn, Abbott-Klafter et al., 2007) across two surveys.

4.1.4 Trends in prevalence of hypercholesterolemia (TC>200 mg/dl) in Thailand, 1992 and 2004

Table 7 and 17 displayed the age-specific and age-standardized prevalence of hypercholesterolemia among Thai population. The age-standardized prevalence of hypercholesterolemia tend to increase between the two surveys by almost 10% in males (27.72% VS 37.03%) and 7% in females (36.85% VS 43.78%). A diiference of prevalence across the two time periods for the population aged 15 and over was statistically significant ($P<0.05$).

Across each age-group 15-49 by year, hypercholesterolemia revealed consistent trends for both sexes. It began to increase from the age of 15 onwards for males and females (see also Figure13). However; across each age-group 50-74 by year hypercholesterolemia revealed inconsistent upwards trends for both sexes. For each year, prevalence of hypercholesterolemia increased with age and peaked at age-group 45-59 and above for males and females. In 2004, the highest prevalence was 48.45% and 65.86% for males and females, respectively. All age-specific hypercholesterolemia prevalence was higher in females than in males, with the range of 10.69-48.45% in males and 21.43-65.86% in females respectively.

Table 8 and Figure12 displayed the age-specific and age-standardized prevalence for hypercholesterolemia by geographic region between 1992 and 2004. It is noted all regions tend to increasing of hypercholesterolemia among age group 15-75+ for both sexes. Prevalence of hypercholesterolemia increased with age. The prevalence of hypercholesterolemia was different by geographic region. In 2004, the percent of prevalence by geographic region was highest in Bangkok (63.28 %), followed by the Central (47.31%), South (47.52%), North (38.75%), and Northeast (31.61%) for both sexes respectively. The highest increasing percent changes were Bangkok (no data for compare VS 62.38%), followed by North 11.44% (27.31% VS 38.75%), Central 10.03% (37.28% VS 47.31%), and South 6.31% (41.21% VS 47.52%), and North 11.44% (27.31% VS 38.75%). The prevalence in females was at least 1 times higher than in males.

Thus, the time trends of hypercholesterolemia in both sexes tend to increase. The percent in females showed higher than males. The total hypercholesterolemia prevalence rates increase at least 1 fold in 12 years for both sexes.

Table 7 Trends in age-specific prevalence of hypercholesterolemia (TC≥200 mg/dl) in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)					Difference
Male	**%**	**N**	**95% CI**			**%**	**N**	**95% CI**			**(%)**
15-19	7.67	61	5.28	-	11.01	10.69	75	7.91	-	14.28	3.02
20-24	12.17	80	8.63	-	16.89	21.20	166	17.85	-	24.97	9.03*
25-29	21.51	104	13.68	-	32.14	30.29	254	25.65	-	35.37	8.78
30-34	27.03	182	20.70	-	34.46	39.04	445	35.26	-	42.96	12.01*
35-39	38.20	225	32.29	-	44.48	42.83	612	38.42	-	47.35	4.63*
40-44	28.44	168	21.47	-	36.60	46.50	667	42.42	-	50.62	18.06*
45-49	39.69	165	29.37	-	51.03	48.45	673	44.11	-	52.81	8.76
50-54	38.01	157	28.10	-	49.04	46.32	589	42.16	-	50.54	8.31*
55-59	34.86	129	25.60	-	45.43	47.22	595	42.59	-	51.89	12.36*
60-64	34.70	116	22.08	-	49.91	44.08	1244	40.77	-	47.43	9.38
65-69	28.84	68	19.66	-	40.16	45.06	1307	41.96	-	48.20	16.22*
70-74	47.23	60	37.50	-	57.17	42.85	1039	39.61	-	46.14	-4.38
75+	29.65	36	20.55	-	40.71	41.63	844	38.04	-	45.32	11.98
Total	**24.56**	**1551**	**19.80**	**-**	**30.03**	**36.68**	**8510**	**34.41**	**-**	**39.00**	**12.12***
Female											
15-19	25.98	167	19.00	-	34.43	21.43	114	17.85	-	25.52	-4.55
20-24	27.26	224	19.62	-	36.54	30.26	166	25.52	-	35.45	3.00
25-29	29.84	281	23.80	-	36.67	31.94	264	27.43	-	36.81	2.10
30-34	27.18	261	18.54	-	37.99	34.73	450	30.91	-	38.75	7.55
35-39	31.23	290	25.61	-	37.46	41.28	581	37.62	-	45.04	10.05*
40-44	32.62	240	26.48	-	39.41	43.94	738	40.59	-	47.36	11.32*
45-49	43.93	233	32.16	-	56.43	51.02	839	47.17	-	54.85	7.09
50-54	46.59	252	35.20	-	58.35	60.85	1009	57.01	-	64.56	14.26*
55-59	49.91	258	40.02	-	59.81	65.86	891	61.37	-	70.08	15.95*
60-64	55.77	206	46.51	-	64.64	62.72	1878	59.26	-	66.06	6.95
65-69	51.23	130	39.61	-	62.73	59.74	1839	56.62	-	62.80	8.51
70-74	56.42	96	45.95	-	66.35	61.59	1480	58.18	-	64.88	5.17
75+	53.84	93	43.89	-	63.49	58.35	1183	54.59	-	62.03	4.51
Total	**33.85**	**2731**	**27.42**	**-**	**40.95**	**43.20**	**11432**	**40.98**	**-**	**45.44**	**9.35***
Both											
15	17.02	228	12.77	-	22.32	15.95	189	13.63	-	18.59	-1.07
20	19.55	304	14.97	-	25.11	25.65	332	22.37	-	29.23	6.10
25	25.76	385	19.86	-	32.69	31.11	518	27.49	-	34.98	5.35
30	27.11	443	19.92	-	35.73	36.87	895	33.81	-	40.04	9.76*
35	34.60	515	30.66	-	38.77	42.04	1193	38.88	-	45.27	7.44*
40	30.55	408	25.23	-	36.43	45.19	1405	42.10	-	48.31	14.64*
45	41.82	398	31.18	-	53.29	49.77	1512	46.57	-	52.97	7.95
50	42.39	409	32.56	-	52.85	53.87	1598	50.58	-	57.13	11.48*
55	42.68	387	33.49	-	52.40	56.97	1486	53.42	-	60.44	14.29*
60	45.70	322	36.67	-	55.02	53.94	3122	50.84	-	57.00	8.24
65	40.65	198	32.04	-	49.88	53.01	3146	50.27	-	55.74	12.36
70	52.25	156	43.39	-	60.97	53.25	2519	50.48	-	56.00	1.00
75+	43.67	129	37.01	-	50.56	51.34	2027	48.27	-	54.39	7.67
Total	**29.30**	**4282**	**23.75**	**-**	**35.53**	**40.01**	**19942**	**37.90**	**-**	**42.16**	**10.71***

* Significant (P-value <.05)

Table 8 Trends in age-specific prevalence of hypercholesterolemia (TC≥200 mg/dl) by geographic region in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)				
Male	**Bangkok**	**Central**	**North**	**Northeast**	**South**	**Bangkok**	**Central**	**North**	**Northeast**	**South**
15-19	-	9.59	5.78	10.67	14.70	31.00	12.50	10.21	7.50	11.28
20-24	-	10.04	11.75	11.60	25.09	45.90	22.90	28.86	13.45	21.79
25-29	-	25.01	14.88	17.34	26.15	50.90	40.20	27.61	22.23	34.75
30-34	-	30.10	19.57	24.27	38.68	54.00	51.30	34.80	28.45	51.29
35-39	-	51.65	23.33	30.71	35.85	65.20	50.50	42.80	31.98	53.78
40-44	-	27.57	29.38	25.13	43.65	74.20	52.10	43.03	37.43	58.54
45-49	-	46.10	33.57	28.90	48.17	79.40	58.20	38.42	38.94	62.54
50-54	-	42.59	26.08	34.22	47.62	69.40	55.90	43.01	36.17	53.55
55-59	-	46.24	25.20	30.05	34.49	82.40	59.30	37.08	37.74	57.07
60-64	-	36.91	36.16	30.36	40.09	58.40	52.60	35.25	38.63	53.70
65-69	-	41.41	29.06	22.40	39.47	69.80	53.40	41.86	34.74	51.73
70-74	-	57.44	43.91	46.72	42.03	63.80	54.50	35.82	31.96	53.22
75+	-	39.11	23.59	19.19	34.55	47.50	52.80	37.22	29.50	49.88
Total	-	**27.61**	**20.35**	**21.43**	**32.64**	**60.20**	**44.90**	**34.41**	**27.61**	**43.29**
Standardized	-	**32.66**	**22.69**	**23.58**	**34.20**	**60.63**	**47.10**	**34.48**	**28.05**	**43.72**
Female										
15-19	-	32.58	17.46	20.88	31.58	36.50	20.60	27.71	17.97	19.51
20-24	-	24.93	23.26	24.84	47.70	51.00	32.00	29.97	28.84	26.72
25-29	-	27.90	28.26	26.15	45.85	50.50	37.40	38.53	21.54	37.06
30-34	-	32.73	25.02	26.59	29.29	62.80	39.90	27.17	26.63	50.38
35-39	-	32.37	26.97	27.90	44.94	53.40	44.40	38.34	36.68	50.62
40-44	-	32.17	28.02	29.88	47.77	65.30	48.90	40.71	34.39	56.94
45-49	-	55.80	33.69	33.73	61.24	67.80	58.70	51.34	39.22	59.90
50-54	-	50.68	38.29	41.32	59.29	75.80	65.80	56.17	51.54	79.21
55-59	-	56.99	39.51	39.72	67.29	89.00	77.90	56.72	57.18	73.84
60-64	-	66.97	58.24	36.83	57.45	82.30	73.60	58.28	51.08	74.35
65-69	-	66.68	44.58	35.86	57.76	82.30	70.10	56.98	43.83	75.03
70-74	-	64.33	57.30	39.33	54.28	81.80	69.40	56.74	52.90	69.41
75+	-	66.95	33.76	45.99	52.78	85.40	63.50	54.74	44.54	73.87
Total	-	**36.96**	**29.70**	**28.75**	**45.26**	**63.40**	**49.00**	**42.31**	**34.52**	**50.75**
Standardized	-	**41.69**	**31.66**	**30.53**	**47.59**	**63.96**	**49.41**	**42.85**	**35.09**	**51.20**
Both										
15-19	-	21.46	11.47	15.77	23.71	33.70	16.50	18.75	12.65	15.26
20-24	-	17.00	17.64	18.24	37.22	48.40	27.30	29.42	21.12	24.19
25-29	-	26.45	21.75	22.01	36.56	50.70	38.80	33.03	21.89	35.91
30-34	-	31.44	22.35	25.47	33.87	58.60	45.40	30.95	27.55	50.83
35-39	-	41.70	25.23	29.26	40.48	58.80	47.30	40.50	34.32	52.18
40-44	-	29.92	28.70	27.48	45.74	69.40	50.40	41.83	35.91	57.72
45-49	-	51.00	33.63	31.29	54.84	73.10	58.50	45.06	39.08	61.19
50-54	-	46.68	32.41	37.90	53.48	72.90	61.20	49.79	44.03	66.88
55-59	-	51.92	32.62	34.99	51.01	85.90	69.20	47.22	47.78	65.84
60-64	-	52.74	47.74	33.70	49.00	71.60	63.90	47.25	45.19	64.51
65-69	-	55.01	37.22	29.49	48.54	76.80	62.50	49.91	39.69	64.36
70-74	-	61.24	51.10	42.67	48.68	74.40	62.80	47.22	43.66	62.11
75+	-	55.45	29.04	35.41	45.17	71.10	59.10	47.21	38.18	63.66
Total	-	**32.33**	**25.13**	**25.18**	**39.22**	**61.90**	**47.00**	**38.46**	**31.10**	**47.09**
Standardized	-	**37.28**	**27.31**	**27.15**	**41.21**	**62.38**	**47.31**	**38.75**	**31.61**	**47.52**

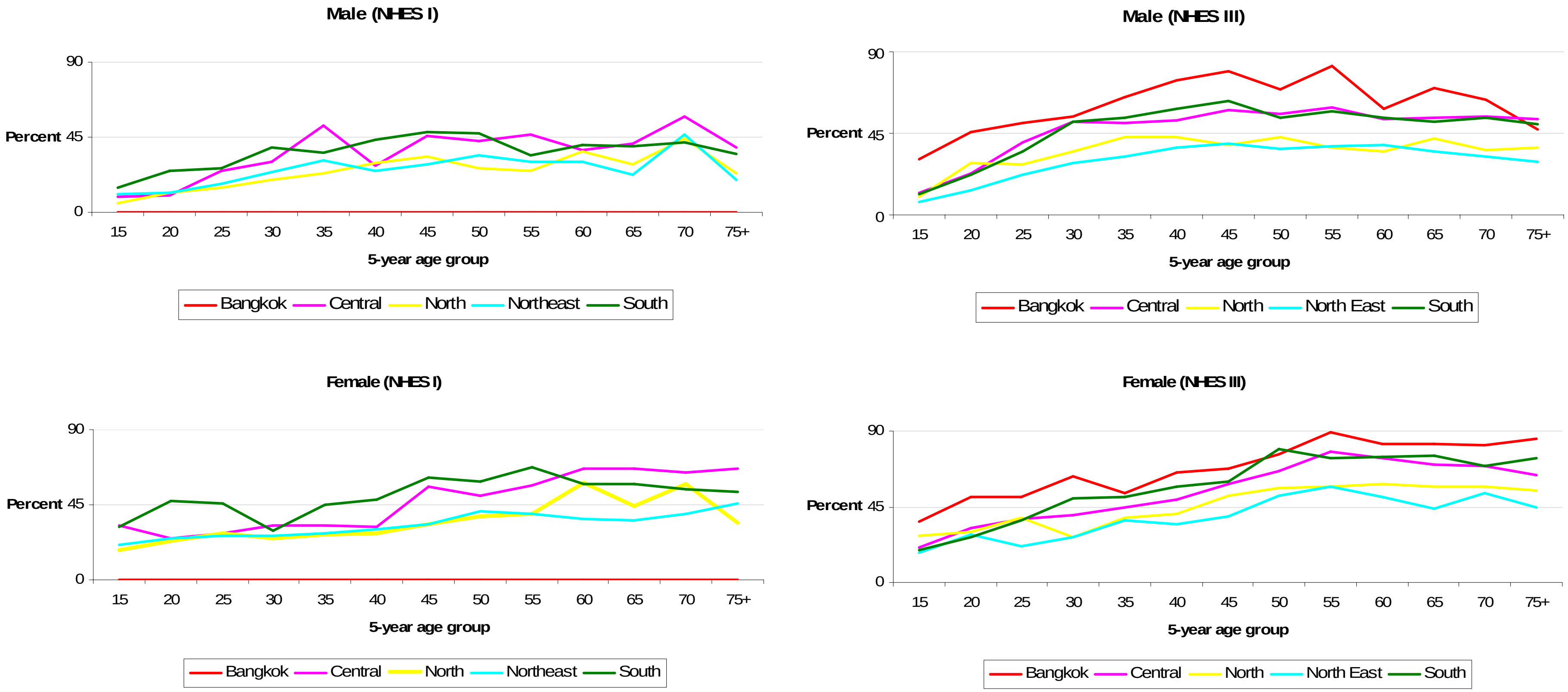


Figure 12 Trends in age-specific prevalence of hypercholesterolemia (TC≥200 mg/dl) by geographic region in Thailand, 1992 and 2004

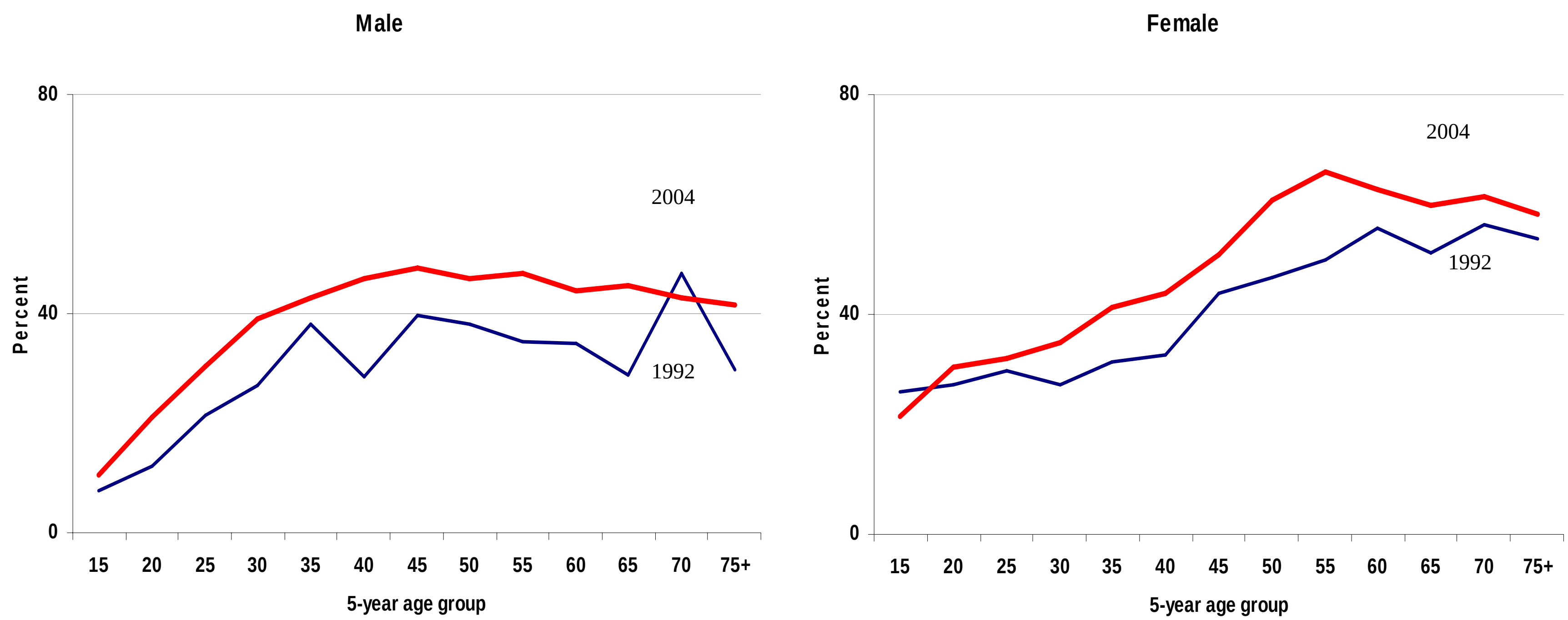


Figure 13 Trends in age-specific prevalence of hypercholesterolemia (TC≥200 mg/dl) in Thailand, 1992 and 2004

4.1.5 Trends in mean of total cholesterol in Thailand, 1992 and 2004

Table 9 and 17 displayed the age-specific and age-standardized mean of total cholesterol among Thai population. The age-standardized mean of TC tend to increase between the two surveys by almost 11 mg/dl in males (178.89 mg/dl VS 189.42 mg/dl) and 9 mg/dl in females (189.32mg/dl VS 198.16 mg/dl). A diiference of mean across the two time periods for the population aged 15 and over was statistically significant (P<0.05).

During this period, the mean of TC increased with age and peaked at age-group 45 and above for males and females. In 2004, the highest mean was 200.80 mg/dl and 222.05mg/dl for males and females, respectively. Most age-specific mean for TC was higher in males than in females (see also Figure15).

In sum, the total mean of TC increased at least one-fold in 12 years for both sexes. The mean in males showed slightly higher than females.

Table10 shows the age-specific and age-standardized mean in TC by geographic region between 1992 and 2004. It is noted all regions tend to increase in mean of TC among age group 15-75+ for both sexes.

Across age group 15-75+ the Central was highest mean when compared with the other regions for both sexes. Mean of TC increased with age at all regions. The mean of TC was different by geographic region. The highest increasing were the Central 27.18 mg/dl (88.48 mg/dl VS 215.66 mg/dl), followed by North 14.22 mg/dl (177.25mg/dl VS 191.47 mg/dl), the South 9.77 mg/dl (192.18 mg/dl VS 201.95 mg/dl), and Northeast 7.26 mg/dl (176.72 mg/dl VS 183.98 mg/dl). In 2004, for males the mean was highest in Bangkok (213.42 mg/dl), followed by the South (196.86 mg/dl), Central (196.07 mg/dl), North (186.05 mg/dl), and Northeast (179.22 mg/dl).

Similarly, it was high in Bangkok (217.65 mg/dl), followed by the South (2006.88 mg/dl), Central (204.01 mg/dl), North (196.66 mg/dl), and Northeast (188.66 mg/dl) for females (see also Figure 14).

Table 9 Mean in age-specific of total cholesterol in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)					Difference
Male	**Mean**	**N**	**95% CI**			**Mean**	**N**	**95% CI**			**(mg/dl)**
15-19	152.72	621	146.66	-	158.78	159.58	650	156.15	-	163.00	6.86*
20-24	169.08	529	159.96	-	178.21	172.44	631	168.60	-	176.28	3.36
25-29	170.69	534	158.10	-	183.27	183.07	715	177.66	-	188.47	12.38
30-34	176.18	642	167.24	-	185.13	189.83	965	186.01	-	193.66	13.65*
35-39	189.10	635	181.13	-	197.08	196.83	1230	192.68	-	200.98	7.73
40-44	182.21	540	174.82	-	189.59	198.89	1250	195.12	-	202.65	16.68*
45-49	190.47	455	183.48	-	197.46	200.80	1198	196.73	-	204.86	10.33*
50-54	187.17	421	176.74	-	197.61	199.70	1118	195.88	-	203.51	12.53*
55-59	188.22	359	179.26	-	197.19	200.50	1064	195.97	-	205.04	12.28*
60-64	187.60	317	174.34	-	200.85	198.83	2490	195.34	-	202.31	11.23
65-69	185.22	209	177.17	-	193.28	200.11	2558	196.82	-	203.40	14.89*
70-74	195.03	130	184.53	-	205.53	195.25	2052	192.07	-	198.43	0.22
75+	185.47	132	176.41	-	194.54	198.23	1781	189.96	-	196.50	12.76
Total	**175.57**	**5524**	**167.97**	**-**	**183.17**	**188.89**	**18835**	**186.32**	**-**	**191.46**	**13.32***
Female											
15-19	176.51	727	168.74	-	184.28	174.18	515	170.55	-	177.81	-2.33
20-24	178.66	762	168.93	-	188.40	183.47	536	178.35	-	188.59	4.81
25-29	179.60	880	171.20	-	188.01	185.62	767	181.12	-	190.11	6.02
30-34	179.68	890	168.35	-	191.02	189.86	1191	186.59	-	193.13	10.18
35-39	185.52	850	180.79	-	190.24	195.04	1425	191.60	-	198.47	9.52*
40-44	182.97	699	173.74	-	192.19	197.46	1586	194.38	-	200.55	14.49*
45-49	195.28	542	186.18	-	204.38	205.61	1515	202.18	-	209.04	10.33*
50-54	203.98	518	192.11	-	215.86	216.67	1567	212.36	-	220.98	12.69*
55-59	205.29	484	194.48	-	216.09	222.05	1251	217.52	-	226.58	16.76*
60-64	212.04	384	202.12	-	221.96	218.12	2780	214.51	-	221.73	6.08
65-69	203.64	263	191.24	-	216.05	217.12	2858	213.86	-	220.37	13.48*
70-74	207.71	177	197.07	-	218.34	216.31	2324	212.61	-	220.00	8.60
75+	206.36	188	195.15	-	217.58	212.98	1953	209.19	-	216.77	6.62
Total	**185.95**	**7364**	**178.14**	**-**	**193.76**	**197.54**	**20268**	**195.18**	**-**	**199.90**	**11.59***
Both											
15-19	164.87	1348	158.18	-	171.56	166.73	1213	164.17	-	169.30	1.86
20-24	173.77	1291	164.91	-	182.62	177.86	1216	174.15	-	181.58	4.09
25-29	175.23	1414	165.46	-	185.01	184.33	1528	180.57	-	188.09	9.10
30-34	177.97	1532	167.96	-	187.99	189.85	2233	186.96	-	192.74	11.88*
35-39	187.25	1485	182.49	-	192.01	195.92	2736	192.96	-	198.87	8.67*
40-44	182.59	1239	174.49	-	190.69	198.16	2922	195.17	-	201.15	15.57*
45-49	192.89	997	185.84	-	199.93	203.28	2815	200.11	-	206.45	10.39
50-54	195.74	939	185.00	-	206.49	208.52	2770	205.21	-	211.84	12.78*
55-59	197.08	843	187.95	-	206.22	211.77	2385	208.10	-	215.45	14.69*
60-64	200.36	701	191.16	-	209.55	209.03	5399	205.75	-	212.31	8.67
65-69	194.94	472	186.31	-	203.57	209.32	5548	206.35	-	212.28	14.38
70-74	201.95	307	192.56	-	211.35	206.94	4497	203.91	-	209.97	4.99
75+	197.58	320	190.26	-	204.90	204.69	3841	201.65	-	207.73	7.11
Total	**180.86**	**12888**	**173.22**	**-**	**188.50**	**193.31**	**39103**	**190.97**	**-**	**195.66**	**12.45***

* Significant (P-value<.05)

Table 10 Mean in age-specific of total cholesterol by geographic region in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)				
Male	Bangkok	Central	North	Northeast	South	Bangkok	Central	North	Northeast	South
15-19	-	153.68	148.46	151.35	156.57	180.83	163.75	159.33	152.96	163.79
20-24	-	170.66	161.59	162.19	179.69	200.54	174.58	175.36	165.18	175.60
25-29	-	172.51	161.25	167.80	177.82	200.57	194.33	180.96	173.22	188.60
30-34	-	175.60	169.59	169.38	194.11	205.10	202.63	183.45	179.15	202.19
35-39	-	197.59	173.69	181.03	191.87	219.19	204.24	196.34	187.22	203.95
40-44	-	183.75	179.47	175.11	191.43	225.65	205.02	195.57	186.93	214.70
45-49	-	197.70	185.33	177.28	194.27	232.26	212.52	190.43	188.94	216.78
50-54	-	185.34	178.78	186.45	203.53	225.27	210.79	197.08	186.13	209.35
55-59	-	193.92	183.35	179.32	190.87	231.98	211.41	191.95	192.12	206.40
60-64	-	192.63	180.65	181.51	190.58	217.80	207.77	187.65	192.20	211.23
65-69	-	189.01	176.59	175.18	200.41	223.79	208.76	195.11	191.66	203.56
70-74	-	201.44	186.72	190.45	193.74	215.16	206.49	187.46	184.18	207.26
75+	-	195.40	177.06	170.53	186.45	211.99	203.02	187.98	180.46	202.02
Total	-	**177.72**	**169.27**	**169.46**	**184.23**	**212.95**	**197.84**	**185.90**	**178.75**	**196.42**
Standardized	-	**182.28**	**172.16**	**172.18**	**185.89**	**213.42**	**196.07**	**186.05**	**179.21**	**196.86**
Female										
15-19	-	179.75	168.55	168.72	185.08	190.90	172.68	183.65	165.95	180.33
20-24	-	176.69	174.51	172.33	197.46	201.91	186.79	178.93	181.94	182.94
25-29	-	177.53	176.22	174.58	195.78	195.47	191.61	186.68	176.21	195.94
30-34	-	183.65	173.16	175.90	180.06	213.00	193.53	186.90	182.52	200.15
35-39	-	190.86	175.71	177.14	192.06	212.08	197.29	193.94	188.99	202.92
40-44	-	181.61	177.82	178.86	198.67	215.23	202.73	194.50	188.42	207.79
45-49	-	201.42	181.56	185.81	206.08	219.45	212.81	203.72	196.58	211.88
50-54	-	210.81	193.05	195.84	208.35	234.87	221.54	212.11	205.33	237.36
55-59	-	209.13	197.57	196.77	217.03	247.88	237.91	210.81	209.39	234.04
60-64	-	220.05	212.14	189.51	216.77	242.52	228.22	211.65	205.69	232.87
65-69	-	210.71	192.39	193.75	212.23	241.01	228.22	210.85	200.37	236.40
70-74	-	216.16	203.75	193.97	205.86	235.93	227.62	211.45	203.45	226.52
75+	-	221.81	183.60	195.76	201.41	244.51	218.44	207.78	196.72	231.40
Total	-	**188.17**	**179.95**	**178.58**	**195.62**	**216.94**	**203.56**	**196.09**	**188.08**	**206.42**
Standardized	-	**193.24**	**182.00**	**181.05**	**197.79**	**217.65**	**204.01**	**196.66**	**188.66**	**206.88**
Both										
15-19	-	167.14	158.24	160.03	171.79	185.84	168.14	171.20	159.35	171.79
20-24	-	173.48	168.21	167.28	189.23	201.21	180.43	177.14	173.54	179.17
25-29	-	175.00	168.94	171.40	187.31	197.91	192.97	183.80	174.69	192.30
30-34	-	179.70	171.42	172.76	186.91	209.26	197.97	185.19	180.82	201.16
35-39	-	194.12	174.74	179.02	191.97	215.36	200.63	195.10	188.10	203.43
40-44	-	182.66	178.65	176.97	195.10	220.01	203.83	195.02	187.68	211.17
45-49	-	199.58	183.45	181.50	200.30	225.34	212.67	197.26	192.81	214.27
50-54	-	198.21	186.17	191.31	205.95	230.45	216.50	204.82	195.95	223.91
55-59	-	201.96	190.72	188.24	204.04	240.60	225.57	201.68	201.04	220.85
60-64	-	207.07	197.16	185.64	204.02	231.49	218.75	200.15	199.30	222.55
65-69	-	200.69	184.90	184.96	206.27	233.41	219.31	203.49	196.40	221.37
70-74	-	209.56	195.86	192.38	200.32	227.43	218.29	200.53	194.95	217.83
75+	-	210.90	180.56	185.80	195.17	232.25	212.11	199.27	189.84	218.89
Total	-	**183.00**	**174.72**	**174.13**	**190.16**	**215.07**	**200.80**	**191.12**	**183.46**	**201.51**
Standardized	-	**188.48**	**177.25**	**176.72**	**192.18**	**215.66**	**201.12**	**191.47**	**183.98**	**201.95**

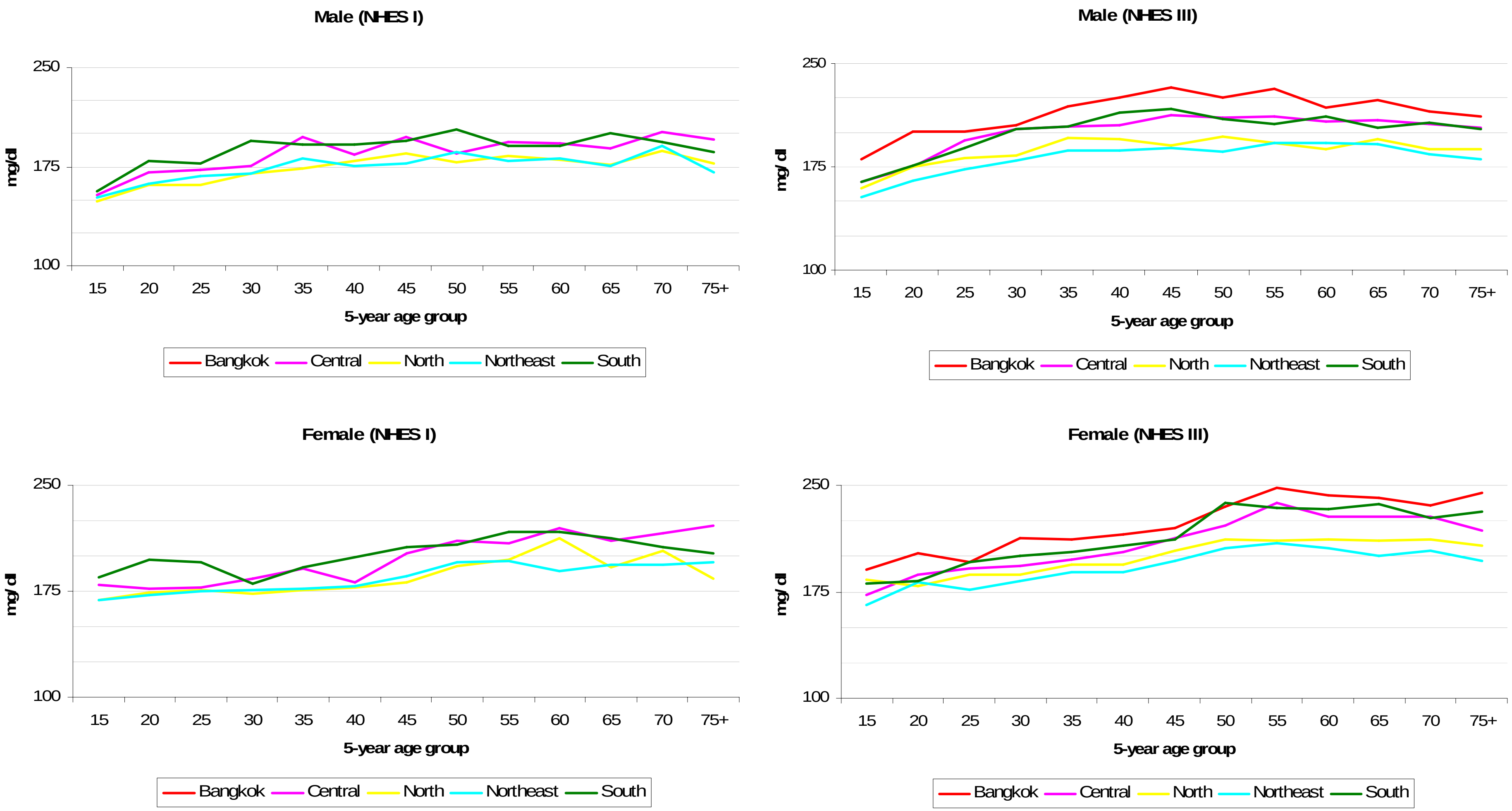


Figure 14 Mean in age-specific of total cholesterol by geographic region in Thailand, 1992 and 2004

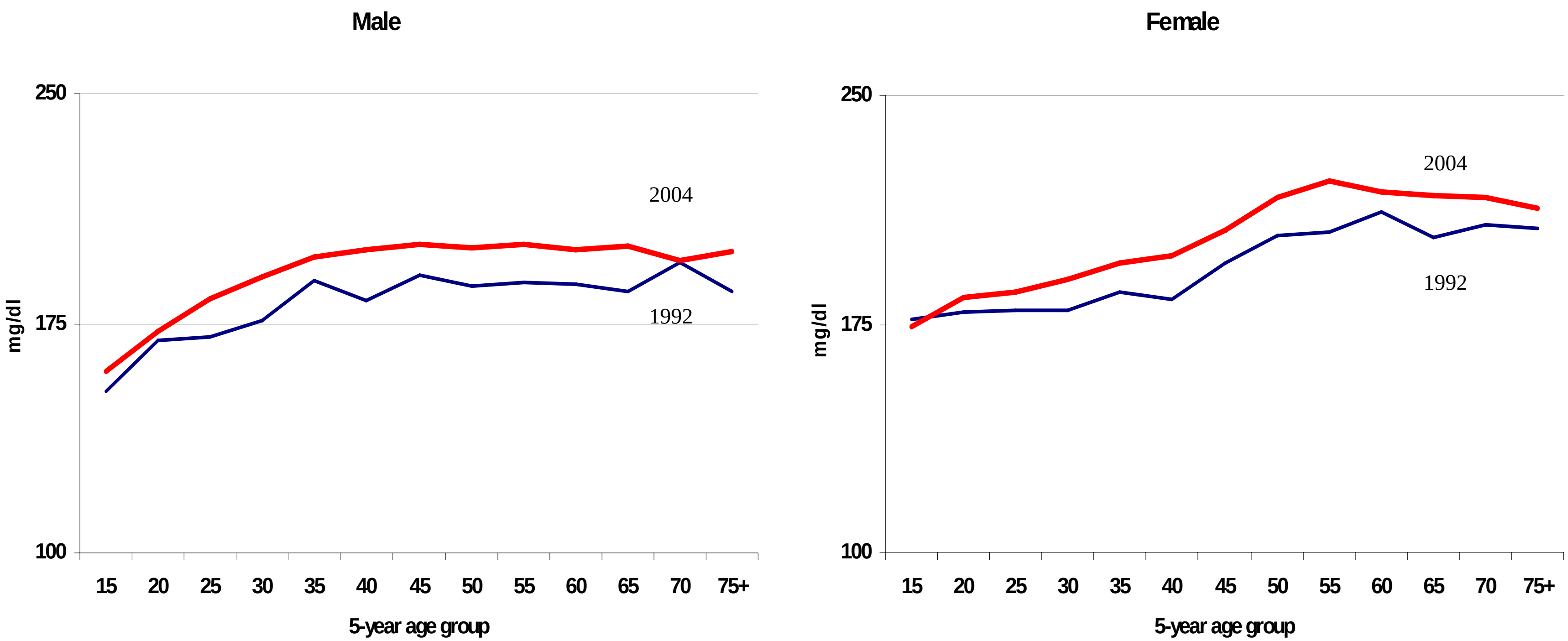


Figure 15 Mean in age-specific of total cholesterol in Thailand, 1992 and 2004

Discussion

Hypercholesterolemia and total cholesterol

Hypercholesterolemia is a major risk factor for coronary heart disease (Arnett et al., 2005). Overall, trends in age-specific and age-standardized hypercholesterolemia prevalence and mean total cholesterol tend to increased. Hypercholesterolemia ($TC \geq 200mg/dl$) shift according to age groups. The prevalence of hypercholesterolemia increased with age as expected. The time trends of hypercholesterolemia and mean total cholesterol look similarly but the rates in females showed higher than males. A diiference across the two time periods for the population aged 15 and over was statistically significant ($P<0.05$).

It is noted all regions tend to increasing of hypercholesterolemia among age group 15-75+ for both sexes. Prevalence of hypercholesterolemia increased with age. The prevalence of hypercholesterolemia was different by geographic region. The highest increasing percent changes were Bangkok (no data for compare), followed by North 11.44% (27.31% VS 38.75%), Central 10.03% (37.28% VS 47.31%), and South 6.31% (41.21% VS 47.52%), and Northeast 4.46% (27.15% VS 31.61 %). The prevalence in females was at least 1 times higher than in males.

Mainly as a result of this, cholesterol increases the risks of heart disease, stroke and other vascular diseases. Increases in the awareness, treatment, and control of hypercholesterolemia are encouraging. The greater than one half of the population who remain unaware of their hypercholesterolemic status points to the continued need for improved screening. Improving screening alone is insufficient; health policy maker should continue to encourage behavioral, dietary, and pharmacological control of cholesterol in those individuals who are aware of their cholesterol risk.

Strenght and limitations

Some limitations should consider across two surveys, cholesterol fractions were not measure such as high-density lipoprotein, low-density lipoprotein, and triglyceride. It is important to establish whether the serum cholesterol fraction in hypercholesterolemia prevalence indicated any obvious in abnormality in lipid metabolism. Despite this limitation, a clear strength of this study is the large sample size and the ability to monitor hypercholesterolemia prevalence and management at a subnational level.

4.1.6 Trends in prevalence of overweight (BMI≥25 kg/m^2) in Thailand, 1992 and 2007

Table11 and 17 displayed the age-specific and age-standardized prevalence of overweight (BMI >25 kg/m2) among Thai population, 1992 and 2004. The age-standardized prevalence of overweight tend to increase between the two surveys by almost 10% in males (12.94% VS 22.82%) and 11% in females (23.71% VS 34.90%). A diiference of prevalence across the two time periods for the population aged 15 and over was statistically significant ($P<0.05$).

Across each age-group 15-59 at the same time, overweight revealed almost upward trends in both sexes. It began to increase from the age of 20 onwards for males and females (see also Figure 17). For each year, prevalence for overweight increased with age and peaked at age-group 30-59 for males and females. In 2004, the highest percent was 31.60% and 48.80% for males and females, respectively. Thereafter, there was significant dropped after age group 60+ for males and females at this time. All age-specific prevalence of overweight was higher in females than in males. The total rate in females was almost 2-fold higher than in males.

Table12 and Figure 16 displayed the age-specific and age-standardized prevalence for overweight by geographic region between 1992 and 2004. It is noted all regions tend to increasing of overweight among age group 15-75+ for both sexes. Prevalence of overweight increased with age. The prevalence of overweight was different by geographic region. In 2004, the percent of prevalence by geographic region was highest in Bangkok (36.55%), the Central (33.64%), followed by South (28.26%), Northeast (26.40%), and North (26.37%) for both sexes respectively. From the 1992 to the 2004, prevalence of overweight increased was as follow: North 12.75% (13.62% VS 26.37%), Central

12.41% (21.23% VS 33.64%), Northeast 11.58% (14.82% VS 26.40%), and South 11.27% (16.99% VS 28.26%) in both sexes. The prevalence of overweight in females was at least 1 times higher than in males.

Thus, the time trends of overweight in both sexes by geographic region tend to increase for both sexes. The patterns prevalence of BMI was similarly among males and females. The total prevalence of overweight increased at least 10% in 12 years for both sexes.

Table 11 Trends in age-specific prevalence for overweight (BMI≥25 kg/m^2) in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)					Difference
Male	**%**	**N**	**95% CI**			**%**	**N**	**95% CI**			**(%)**
15-19	3.10	14	1.50	-	6.40	9.30	77	7.00	-	12.30	6.20*
20-24	6.60	28	4.30	-	10.00	15.30	124	12.50	-	18.50	8.70*
25-29	6.00	39	4.40	-	8.10	18.60	167	15.00	-	22.80	12.60*
30-34	13.30	93	10.00	-	17.60	24.20	274	21.00	-	27.60	10.90*
35-39	19.50	111	15.70	-	23.90	26.60	384	23.30	-	30.10	7.10*
40-44	17.70	109	14.10	-	21.80	28.60	431	25.50	-	32.10	10.90*
45-49	19.60	100	14.90	-	25.40	31.60	466	28.50	-	34.90	12.00*
50-54	16.50	91	10.80	-	24.30	31.40	423	28.20	-	34.80	14.90*
55-59	18.00	81	14.00	-	22.80	30.10	394	26.30	-	34.10	12.10*
60-64	14.60	53	10.80	-	19.60	24.60	747	22.30	-	27.00	10.00*
65-69	18.40	37	11.30	-	28.40	21.00	647	18.90	-	23.30	2.60*
70-74	6.50	16	3.40	-	12.20	17.00	426	15.30	-	18.80	10.50*
75+	8.60	14	2.90	-	22.90	11.60	278	9.90	-	13.60	3.00
Total	**11.30**	**786**	**9.30**	**-**	**13.60**	**22.60**	**4838**	**21.00**	**-**	**24.20**	**11.30***
Female											
15-19	5.90	56	4.40	-	7.80	13.00	72	9.60	-	17.40	7.10*
20-24	9.00	79	6.50	-	12.50	21.20	118	17.50	-	25.40	12.20*
25-29	16.60	176	13.40	-	20.50	26.60	211	23.10	-	30.40	10.00*
30-34	24.20	226	21.10	-	27.70	35.30	430	31.60	-	39.20	11.10*
35-39	28.70	287	24.20	-	33.60	41.30	578	38.00	-	44.70	12.60*
40-44	34.50	299	30.70	-	38.50	46.20	719	42.40	-	50.10	11.70*
45-49	37.00	228	34.10	-	40.00	48.80	773	45.00	-	52.70	11.80*
50-54	35.30	231	28.50	-	42.70	47.30	810	43.10	-	51.50	12.00*
55-59	28.20	176	22.50	-	34.70	47.10	648	43.00	-	51.20	18.90*
60-64	28.30	132	18.80	-	40.30	38.00	1207	35.20	-	40.90	9.70*
65-69	26.90	85	20.60	-	34.40	34.10	1085	31.60	-	36.70	7.20*
70-74	21.10	54	14.70	-	29.40	28.30	723	25.80	-	30.90	7.20*
75+	7.40	27	3.70	-	14.20	17.40	428	15.10	-	19.90	10.00*
Total	**20.60**	**2056**	**18.30**	**-**	**23.10**	**34.50**	**7802**	**33.00**	**-**	**36.00**	**13.90***
Both											
15-19	4.50	70	3.40	-	6.00	11.10	149	8.90	-	13.80	6.60*
20-24	7.80	107	5.80	-	10.50	18.20	242	15.80	-	20.90	10.40*
25-29	11.50	215	9.20	-	14.20	22.60	378	19.60	-	25.80	11.10*
30-34	18.90	319	16.60	-	21.40	29.80	704	27.30	-	32.30	10.90*
35-39	24.20	398	20.10	-	28.80	34.10	962	31.80	-	36.50	9.90*
40-44	26.20	408	23.30	-	29.30	37.60	1150	35.00	-	40.30	11.40*
45-49	28.40	328	25.80	-	31.30	40.50	1239	37.80	-	43.30	12.10*
50-54	26.20	322	20.00	-	33.50	39.70	1233	36.80	-	42.60	13.50*
55-59	23.30	257	18.70	-	28.60	39.00	1042	36.10	-	41.90	15.70*
60-64	21.70	185	15.90	-	28.80	31.70	1954	29.50	-	34.00	10.00*
65-69	22.90	122	16.50	-	30.90	28.10	1732	26.20	-	30.10	5.20*
70-74	14.50	70	10.10	-	20.40	23.30	1149	21.80	-	24.80	8.80*
75+	7.90	41	4.40	-	13.90	14.90	706	13.30	-	16.70	7.00*
Total	**16.10**	**2842**	**14.00**	**-**	**18.30**	**28.70**	**12640**	**27.30**	**-**	**30.00**	**12.60***

* Significant (P-value < .05)

Table 12 Trends in age-specific prevalence for overweight (BMI≥25 kg/m^2) by geographic region in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)				
Male	**Bangkok**	**Central**	**North**	**Northeast**	**South**	**Bangkok**	**Central**	**North**	**Northeast**	**South**
15-19	2.30	5.40	0.70	1.00	1.50	21.50	13.50	10.70	6.10	6.20
20-24	2.00	8.80	3.40	4.30	5.30	14.10	20.90	17.70	12.00	11.50
25-29	5.70	5.60	8.90	3.80	6.70	14.40	23.40	18.60	16.40	17.60
30-34	24.10	15.30	8.40	12.00	11.70	31.30	33.00	22.50	21.30	16.80
35-39	18.20	29.10	6.20	11.90	15.80	46.70	32.20	24.40	22.90	23.20
40-44	28.30	21.50	13.10	13.10	14.40	37.10	36.30	25.90	23.70	28.10
45-49	42.40	23.10	11.60	16.00	18.00	41.50	35.20	29.60	28.50	32.50
50-54	25.00	16.90	12.00	21.80	9.60	51.10	38.90	29.10	23.90	32.90
55-59	43.80	18.30	15.30	16.10	16.30	31.00	36.00	26.20	29.70	25.90
60-64	25.60	16.70	9.70	13.70	12.60	37.80	29.50	20.40	23.00	21.70
65-69	30.80	24.70	10.50	13.50	12.00	39.70	25.70	17.40	18.00	19.00
70-74	22.20	1.20	6.30	13.50	8.10	22.40	21.20	15.00	16.40	12.50
75+	28.70	11.10	4.40	5.20	3.30	17.10	13.00	8.70	12.40	10.60
Total	**15.70**	**13.60**	**7.60**	**9.00**	**9.50**	**31.60**	**28.40**	**21.50**	**19.30**	**19.30**
Standardized	**21.25**	**15.78**	**8.51**	**10.45**	**10.18**	**31.92**	**28.60**	**21.65**	**19.56**	**19.62**
Female										
15-19	4.80	5.20	3.30	6.00	10.70	21.90	13.10	13.10	7.70	22.90
20-24	8.70	9.60	10.50	5.60	10.10	28.20	20.40	22.10	21.40	18.90
25-29	22.20	18.20	15.50	11.20	17.80	21.00	27.60	28.60	23.50	32.10
30-34	23.90	27.90	17.80	17.00	28.20	37.10	37.60	31.90	33.60	39.70
35-39	35.00	32.90	19.10	26.50	27.80	45.10	37.50	41.20	43.50	41.60
40-44	53.30	37.30	33.60	31.10	24.10	46.70	50.50	37.90	48.10	46.40
45-49	45.90	44.20	22.00	28.40	40.10	43.40	54.90	42.10	48.20	52.00
50-54	51.80	37.70	26.90	31.80	34.80	53.60	54.20	38.00	47.60	45.20
55-59	53.20	28.90	22.70	24.40	30.80	61.70	58.60	33.10	42.80	52.20
60-64	42.90	34.80	16.10	16.90	32.10	55.20	45.60	30.70	33.30	41.10
65-69	65.10	34.80	16.50	13.50	20.60	52.60	43.40	25.80	27.70	37.90
70-74	40.70	20.70	11.60	23.60	25.30	46.40	32.90	22.60	24.30	32.70
75+	31.00	0.90	10.00	8.40	14.80	30.20	22.80	11.20	13.40	19.90
Total	**27.90**	**22.40**	**16.80**	**16.60**	**21.80**	**40.10**	**37.90**	**30.80**	**32.70**	**36.30**
Standardized	**35.20**	**26.52**	**18.45**	**18.99**	**23.51**	**40.59**	**38.37**	**30.86**	**33.11**	**36.60**
Both										
15-19	3.50	5.30	2.00	3.50	6.30	21.70	13.30	11.90	6.80	14.20
20-24	5.50	9.20	7.00	5.00	7.80	21.20	20.60	19.90	16.70	15.10
25-29	14.10	11.90	12.30	7.70	12.60	17.90	25.50	23.60	19.80	24.90
30-34	24.00	21.60	13.30	14.50	20.20	34.40	35.40	27.20	27.40	28.30
35-39	26.80	31.00	12.80	19.40	21.90	45.80	34.90	33.00	33.20	32.50
40-44	41.10	29.50	23.60	22.20	19.40	42.30	43.70	32.00	35.90	37.40
45-49	44.40	33.90	16.80	22.10	28.90	42.50	45.60	36.10	38.50	42.60
50-54	40.40	27.60	19.80	27.00	22.40	52.40	47.00	33.70	36.10	39.30
55-59	48.70	23.80	19.20	20.30	23.60	47.50	48.10	29.80	36.40	39.70
60-64	34.80	26.20	12.90	15.30	22.40	47.50	38.10	25.80	28.40	31.80
65-69	48.30	30.20	13.60	13.50	16.30	47.00	35.20	21.90	23.30	29.20
70-74	32.30	12.20	9.20	18.80	17.20	36.50	27.70	19.10	20.80	23.60
75+	29.90	5.00	7.70	7.00	10.00	25.30	18.70	10.10	13.00	15.80
Total	**22.10**	**18.00**	**12.30**	**12.80**	**15.80**	**36.10**	**33.30**	**26.20**	**26.10**	**28.00**
Standardized	**28.54**	**21.23**	**13.62**	**14.82**	**16.99**	**36.55**	**33.64**	**26.37**	**26.40**	**28.26**

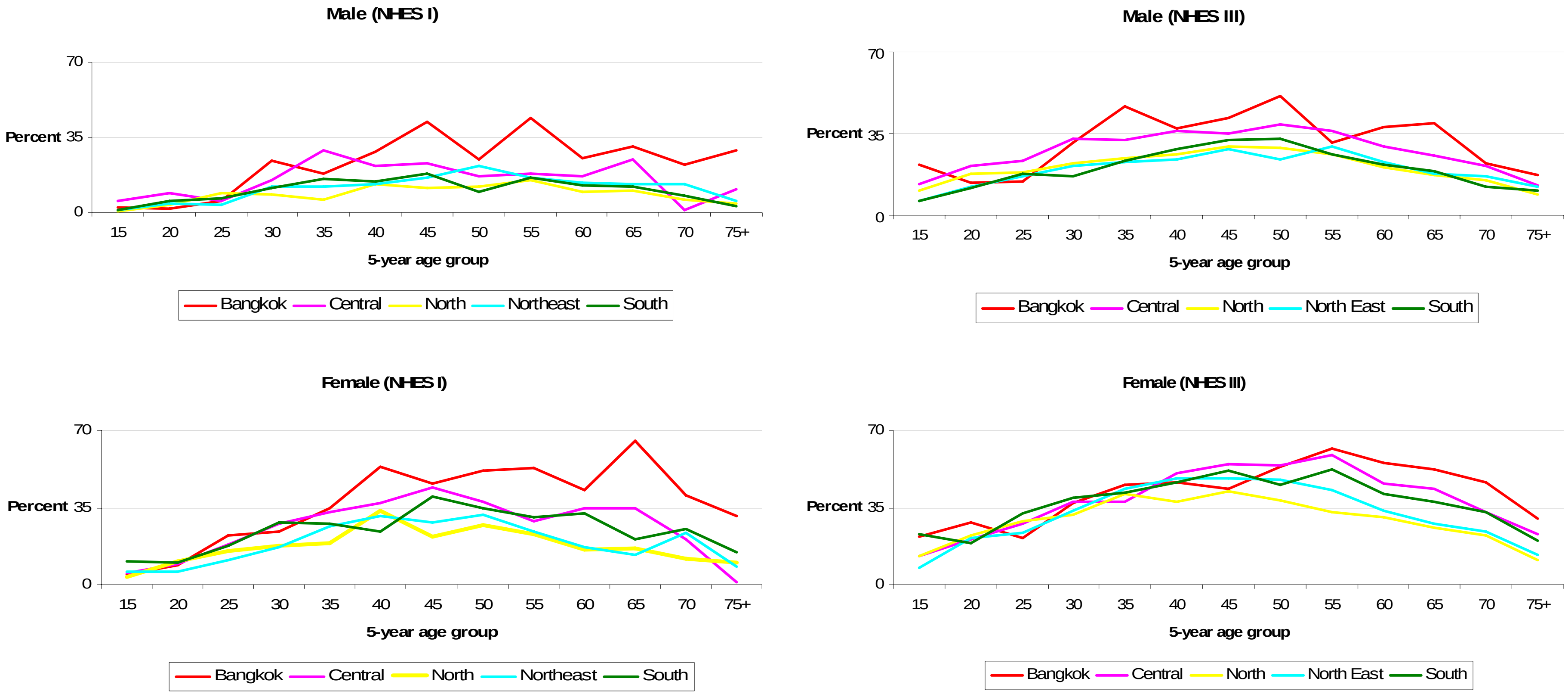


Figure 16 Trends in age-specific prevalence of overweight by geographic region in Thailand, 1992 and 2004

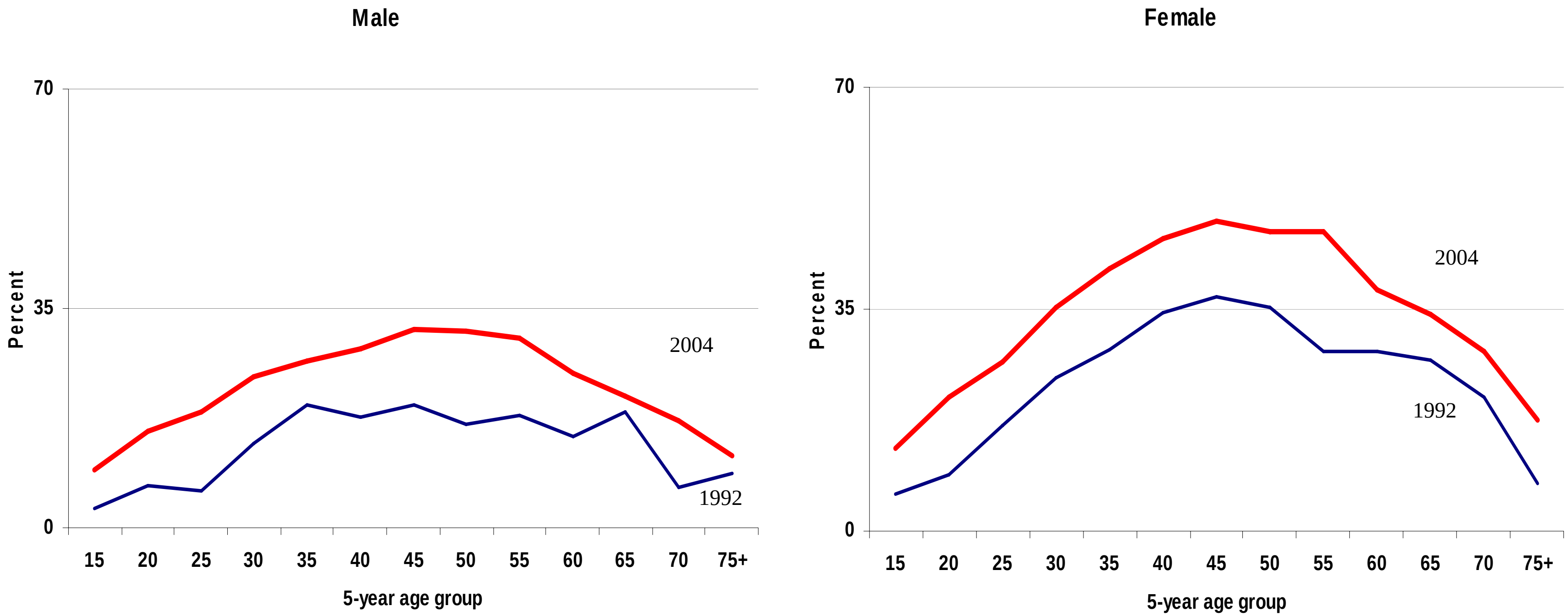


Figure 17 Trends in age-specific prevalence of overweight (BMI≥25kg/m^2) in Thailand, 1992 and 2004

4.1.7 Trends in prevalence of obesity (BMI ≥30 kg/m^2) in Thailand, 1992 and 2004

Table13 and 17 displayed the age-specific and age-standardized prevalence of obesity (BMI >30 kg/m2) among Thai population, 1992 and 2004. The age-standardized prevalence of obesity tend to increase between the two surveys by almost 3% in males (1.55% VS 4.80%) and 2% in females (5.45% VS 9.13%). A diiference of prevalence across the two time periods for the population aged 15 and over was statistically significant (P<0.05).

Across each age-group 15-59 at the same time, obesity revealed upward trends for both sexes. It increased from the age of 25 and 15 onwards for males and females respectively (see also Figure19). For each year, prevalence for obesity increased with age and peaked at age-group 40-59 for males and females. In 2004, the highest percent was 6.07% and 12.69% for males and females, respectively. Thereafter, there was markedly dropped in age groups 60+ for males and females. All age-specific prevalence of obesity was higher in females than in males. The total rate in females was almost 2-fold higher than in males.

Table14 and Figure 18 displayed the age-specific and age-standardized prevalence for obesity by geographic region between 1992 and 2004. It is noted all regions tend to increasing of obesity among age group 15-59 for both sexes. Thereafter, there was markedly dropped in age groups 60+ for males and females. The prevalence of obesity was different by geographic region. In 2004, the percent of prevalence of obesity by geographic region was highest in Bangkok (10.47%), Central (7.92%), South (7.17%), Northeast (5.87%), and North (5.20%) for both sexes respectively. The highest increasing percent were the South 4.26% (2.91% VS

7.17%), followed by Northeast 3.46% (2.44% VS 5.20%), Bangkok 3.45% (7.02% VS 10.47%), Central 2.83% (5.09% VS 7.92%), and North 2.76% (2.44% VS 5.20%). The prevalence in females was almost twofold higher than in males.

Thus, the time trends of age-specific and age-standardized prevalence of obesity in both sexes tend to increase. The percent in females showed higher than males. The total obesity prevalence rates increase almost two-fold in 12 years for both sexes

Table 13 Trends in age-specific prevalence of obesity (BMI≥30kg/m^2) in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)					Difference
Male	**%**	**N**	**95% CI**			**%**	**N**	**95% CI**			**(%)**
15-19	0.89	4	0.28	-	2.82	3.77	31	2.49	-	5.69	2.88*
20-24	0.10	2	0.03	-	0.35	5.78	36	3.68	-	8.97	5.68*
25-29	0.18	2	0.04	-	0.74	4.71	40	2.90	-	7.54	4.53*
30-34	1.73	7	0.75	-	3.93	4.85	55	3.45	-	6.78	3.12*
35-39	2.71	21	1.41	-	5.14	4.98	69	3.63	-	6.80	2.27*
40-44	2.53	16	0.94	-	6.65	5.61	82	4.18	-	7.48	3.08*
45-49	3.58	13	1.86	-	6.79	5.46	86	3.93	-	7.54	1.88
50-54	1.37	13	0.70	-	2.68	6.07	81	4.32	-	8.47	4.70*
55-59	1.41	7	0.72	-	2.74	5.87	76	4.37	-	7.83	4.46*
60+	1.14	11	0.49	-	2.63	2.29	270	1.93	-	2.71	1.15*
Total	**1.31**	**96**	**1.01**	-	**1.69**	**4.79**	**826**	**4.16**	-	**5.51**	2.60*
Female											
15-19	0.59	8	0.35	-	0.97	3.80	22	2.33	-	6.16	3.21*
25-29	3.35	36	1.71	-	6.46	8.36	74	6.35	-	10.94	5.01*
30-34	5.71	53	3.54	-	9.10	8.64	115	7.00	-	10.61	2.93
35-39	6.46	61	4.26	-	9.66	11.42	160	9.43	-	13.77	4.96*
40-44	8.10	68	6.40	-	10.20	12.28	207	10.66	-	14.10	4.18
45-49	9.43	54	6.06	-	14.39	11.36	201	9.57	-	13.43	1.93
50-54	6.93	50	3.54	-	13.13	12.69	220	10.41	-	15.39	5.76*
55-59	5.11	34	3.17	-	8.13	12.22	179	9.58	-	15.45	7.11*
60+	6.08	68	4.29	-	8.55	6.63	803	5.80	-	7.57	0.55
Total	**4.62**	**448**	**4.15**	-	**5.14**	**9.04**	**2020**	**8.39**	-	**9.74**	**3.48***
Both											
15-19	0.73	12	0.34	-	1.60	3.79	53	2.71	-	5.27	3.06*
20-24	1.09	18	0.48	-	2.43	6.00	75	4.56	-	7.86	4.91*
25-29	1.79	38	0.91	-	3.52	6.52	114	5.14	-	8.24	4.73*
30-34	3.78	60	2.87	-	4.94	6.75	170	5.63	-	8.08	2.97*
40-44	5.36	84	4.39	-	6.52	9.01	289	7.88	-	10.29	3.65*
45-49	6.55	67	4.14	-	10.20	8.51	287	7.21	-	10.02	1.96
50-54	4.25	63	2.36	-	7.52	9.52	301	7.77	-	11.60	5.27*
55-59	3.32	41	2.33	-	4.72	9.18	255	7.85	-	10.71	5.86*
60+	3.80	79	2.70	-	5.33	4.67	1073	4.12	-	5.29	0.87
Total	**3.00**	**544**	**2.64**	-	**3.41**	**6.96**	**2846**	**6.42**	-	**7.54**	**4.42***

* Significant (P-value<.05)

Table 14 Trends in age-specific prevalence of obesity (BMI≥30kg/m^2) by geographic region in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)				
Male	**Bangkok**	**Central**	**North**	**Northeast**	**South**	**Bangkok**	**Central**	**North**	**Northeast**	**South**
15-19	2.27	1.27	-	0.36	1.02	14.00	5.60	4.37	2.15	1.73
20-24	-	-	-	0.38	0.26	4.90	6.90	6.53	6.06	2.64
25-29	-	0.17	0.63	-	-	-	4.50	6.37	4.60	4.64
30-34	1.72	2.99	0.37	0.38	1.07	3.90	7.00	3.87	3.93	5.32
35-39	4.55	3.03	2.40	2.29	2.15	10.70	5.30	2.12	6.13	3.45
40-44	5.66	3.10	1.25	2.10	2.06	10.80	7.90	2.61	5.99	3.15
45-49	3.03	5.69	0.63	2.47	2.57	4.10	7.70	3.73	5.35	4.76
50-54	2.78	0.21	-	4.18	2.56	6.20	8.70	3.28	7.07	3.07
55-59	-	0.30	2.73	1.27	3.55	8.70	8.30	6.04	4.31	4.31
60+	1.90	1.30	0.30	1.25	1.46	3.50	3.50	1.54	1.89	1.71
Total	**1.90**	**1.60**	**0.71**	**1.11**	**1.29**	**6.50**	**6.30**	**3.84**	**4.65**	**3.36**
Standardized	**2.31**	**1.62**	**0.76**	**1.34**	**1.46**	**6.53**	**4.99**	**3.85**	**4.65**	**3.38**
Female										
15-19	-	0.36	-	0.54	2.06	12.30	4.80	1.05	2.30	6.84
20-24	2.20	2.34	2.12	1.62	1.76	10.20	7.80	5.39	4.73	7.47
25-29	7.10	3.52	3.05	2.15	3.49	12.20	12.00	9.35	3.77	11.84
30-34	5.60	7.19	3.71	2.87	7.24	16.80	12.40	7.58	7.01	5.09
35-39	10.80	8.45	6.10	4.34	2.30	13.40	11.10	10.20	11.35	13.34
40-44	13.10	8.71	9.40	5.92	6.45	17.10	18.90	6.07	8.96	15.37
45-49	14.10	14.36	3.95	6.88	2.89	11.50	14.90	8.54	7.86	18.12
50-54	14.50	7.40	3.66	5.11	9.97	15.00	17.30	8.19	11.15	13.81
55-59	8.10	4.50	5.71	5.05	5.39	23.20	16.20	6.15	11.17	12.34
60+	13.60	9.50	2.53	1.33	3.83	14.90	8.50	3.41	5.23	8.59
Total	**7.50**	**5.59**	**3.65**	**2.95**	**4.03**	**14.40**	**12.00**	**6.51**	**6.96**	**10.71**
Standardized	**9.43**	**8.15**	**4.03**	**3.35**	**4.27**	**14.51**	**10.46**	**6.49**	**7.05**	**10.80**
Both										
15-19	1.20	0.80	-	0.45	1.57	13.10	5.20	2.74	2.22	4.19
20-24	1.10	1.10	1.07	1.01	1.04	7.60	7.30	5.96	5.39	5.01
25-29	3.60	1.80	1.87	1.13	1.83	6.40	8.20	7.85	4.19	8.27
30-34	3.90	5.10	2.11	1.66	4.25	10.70	9.70	5.74	5.45	5.21
35-39	7.80	5.80	4.30	3.34	2.23	12.20	8.30	6.27	8.75	8.46
40-44	9.50	5.90	5.41	4.03	4.30	14.20	13.70	4.38	7.47	9.40
45-49	9.50	10.10	2.31	4.65	2.72	8.10	11.50	6.20	6.63	11.66
50-54	9.50	3.90	1.92	4.66	6.31	10.90	13.30	5.79	9.16	8.66
55-59	4.20	2.50	4.30	3.19	4.48	16.50	12.50	6.10	7.84	8.51
60+	8.10	5.80	1.48	1.29	2.71	10.10	6.30	2.55	3.72	5.45
Total	**4.80**	**3.60**	**2.22**	**2.05**	**2.71**	**10.70**	**9.20**	5.20	**5.81**	**7.11**
Standardized	**7.02**	**5.09**	**2.44**	**2.41**	**2.91**	**10.47**	**7.92**	**5.20**	**5.87**	**7.17**

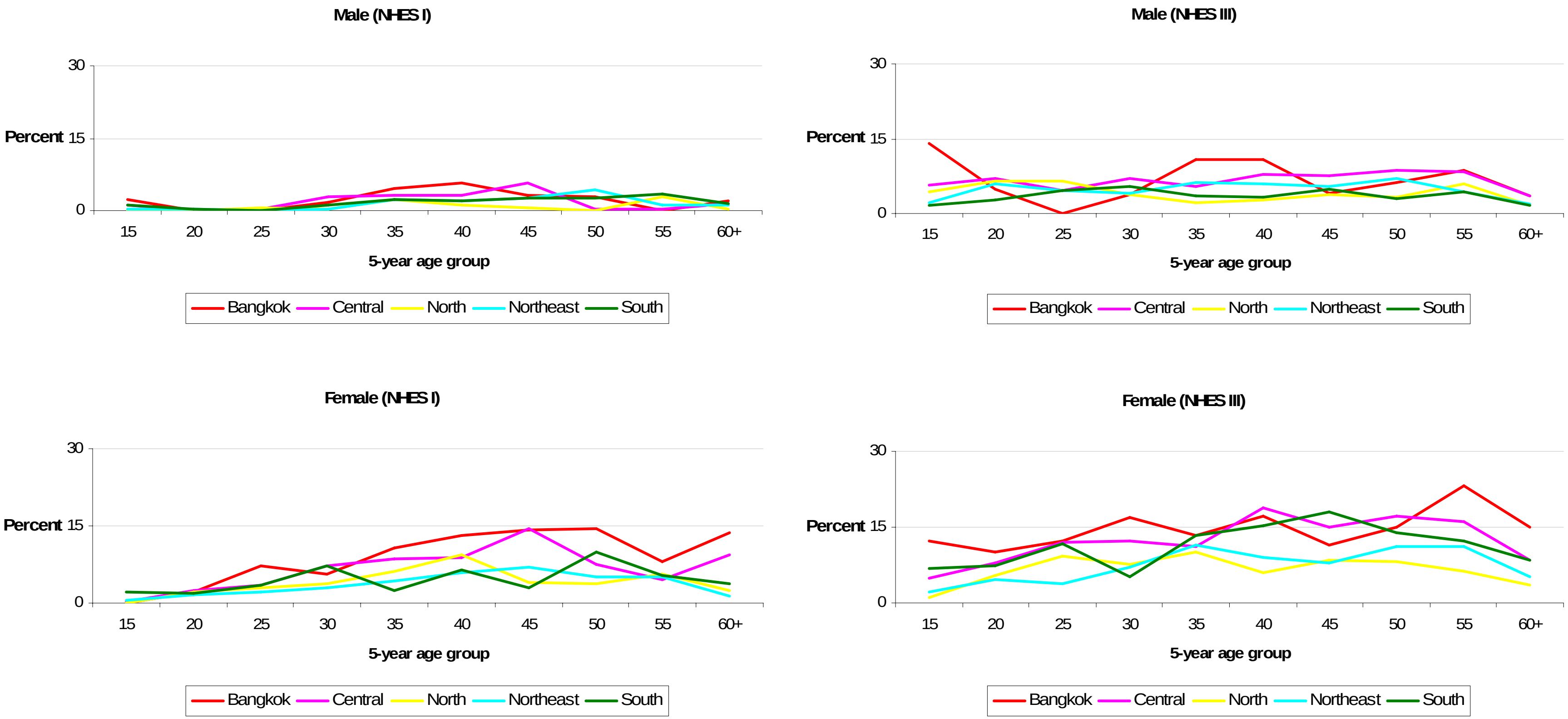


Figure 18 Trends in age-specific prevalence of obesity by geographic region in Thailand, 1992 and 2004

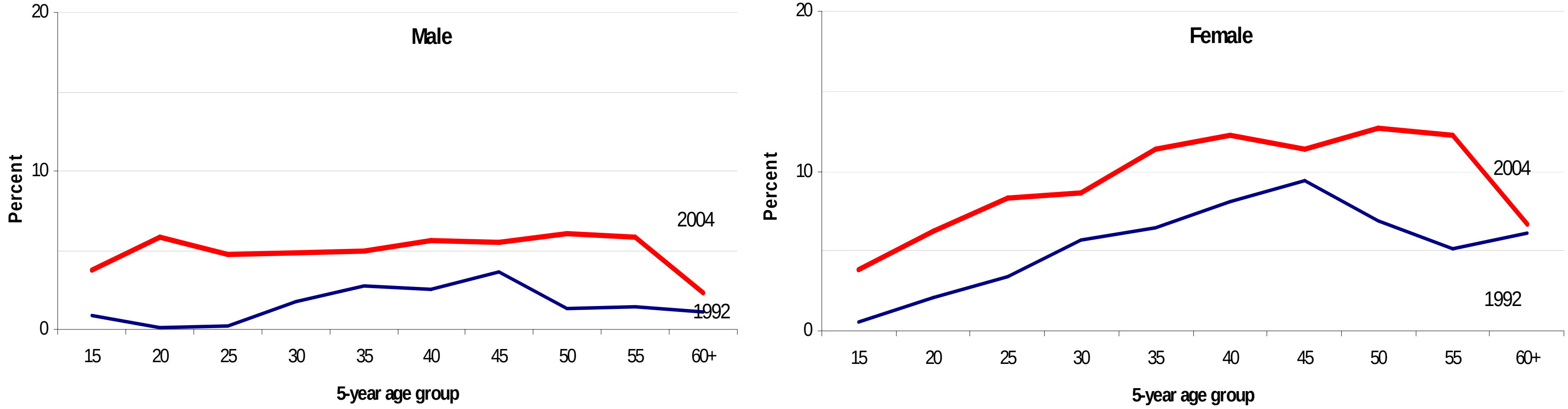


Figure 19 Trends in age-specific prevalence of obesity in Thailand, 1992 and 2004

4.1.8 Trends in mean of body mass index (BMI) in Thailand, 1992 and 2004

Table 15 presented the age-specific and age-standardized mean of BMI (95% CI) between NHES I (1992) and NHES III (2004). A comparison of the mean of BMI across the two time periods for the population aged 15 and above showed that, overall, BMI increased significantly between the two surveys by almost 1.25 kg/m² in males (21.38 kg/m² VS 22.63 kg/m²) and 1.21 kg/m² in females (22.63 kg/m² VS 23.84 kg/m²). A diiference of mean across the two time periods for the population aged 15 and over was statistically significant ($P<0.05$).

Across each age-group 15-39 at the same time, BMI revealed upward trends for both sexes. (see also Figure 21). For each year, mean for BMI increased with age and peaked at age-group 50-54 for males and females. In 2004, the highest mean was 23.54 kg/m² and 25.23 kg/m² for males and females, respectively. Thereafter, there was slightly dropped in age groups 55 and above for both sexes at this time. All age-specific mean of BMI was higher in females than in males, with the range of 20.70 kg/m²-23.54 kg/m² and 19.69-22.15 kg/m² person-years respectively. The average mean in females was almost 2 times higher than in males.

Table 16 and Figure 20 showed the age-specific and age-standardized mean of BMI by geographic region between 1992 and 2004. Clearly, all regions tend to increase in mean of BMI among age group 15-59 for both sexes. The mean of BMI increased with age group 15-59 and thereafter it tend to drop among age 60 and above. From the 1992 to the 2004,: Bangkok increased 0.96 kg/m2 (from 23.17 kg/m² to 24.13 kg/m²), Central increased 1.40 kg/m2 (from 22.35 kg/m² to 23.75 kg/m²), North increased 1.51 kg/ m2 (21.34 VS 22.85 kg/m²), Northeast increased 1.26 kg/m²

(21.75 VS 23.01 kg/m^2), and South increased 1.35 kg/m^2 (from 21.79 kg/m^2 to 23.14 kg/m^2) for both sexes. In 2004, for males, the highest mean of BMI by geographic region was Bangkok (23.39 kg/m^2), the Central (23.71 kg/m^2), followed by Northeast (22.45 kg/m^2), north (22.37 kg/m^2), and South (22.18 kg/m^2) respectively and for females were Bangkok (24.77 kg/m^2), the Central (24.27 kg/m^2), South (24.07 kg/m^2), Northeast (23.54 kg/m^2), and North (23.32 kg/m^2) respectively.

Thus, trends in age-standardized mean of BMI tend to increase. The patterns mean of BMI were similarly among males and females. The total mean of BMI increase at least 1 Kg/m^2 in 12 years for both sexes.

Table 15 Mean in age-specific body mass index in Thailand, 1992 and 2004

	NHES I (1992)				NHES III (2004)				Difference
Male	Mean	N	95% CI		Mean	N	95% CI		(kg/m²)
15-19	19.69	700	19.44 -	19.94	20.70	700	20.35 -	21.05	1.01*
20-24	20.71	595	20.38 -	21.04	21.96	675	21.56 -	22.37	1.25*
25-29	20.99	611	20.81 -	21.18	22.44	760	22.04 -	22.83	1.45*
30-34	21.77	725	21.46 -	22.08	22.99	1044	22.68 -	23.31	1.22*
35-39	22.10	720	21.98 -	22.23	23.17	1311	22.89 -	23.46	1.07*
40-44	22.15	597	21.54 -	22.76	23.46	1342	23.14 -	23.77	1.31*
45-49	22.12	494	21.77 -	22.47	23.54	1296	23.26 -	23.83	1.42*
50-54	22.00	464	21.44 -	22.55	23.51	1202	23.24 -	23.77	1.51*
55-59	21.61	398	21.14 -	22.08	23.24	1133	22.91 -	23.57	1.63*
60-64	21.59	367	21.15 -	22.04	22.62	2616	22.38 -	22.87	1.03*
65-69	21.71	236	20.90 -	22.52	22.13	2684	21.90 -	22.36	0.42
70-74	20.19	148	19.66 -	20.72	21.65	2166	21.41 -	21.89	1.46*
75+	19.64	146	18.76 -	20.52	20.66	1872	20.42 -	20.90	1.02*
Total	**21.20**	**6201**	**21.00 -**	**21.41**	**22.60**	**18801**	**22.42 -**	**22.78**	**1.40***
Female									
15-19	20.57	824	20.41 -	20.73	21.15	1524	20.69 -	21.62	0.58*
20-24	21.40	887	21.12 -	21.69	22.33	1482	21.92 -	22.73	0.93*
25-29	22.15	1035	21.73 -	22.57	23.30	1646	22.86 -	23.73	1.15*
30-34	22.87	1067	22.57 -	23.17	24.15	1792	23.82 -	24.48	1.28*
35-39	23.23	991	22.86 -	23.59	24.74	1711	24.43 -	25.04	1.51*
40-44	23.87	829	23.50 -	24.24	25.15	1426	24.86 -	25.44	1.28*
45-49	24.20	633	23.80 -	24.60	25.23	1127	24.89 -	25.56	1.03*
50-54	23.65	618	22.92 -	24.37	25.16	1082	24.78 -	25.54	1.51*
55-59	22.55	555	22.09 -	23.01	24.92	953	24.49 -	25.34	2.37*
60-64	22.60	456	21.85 -	23.36	24.00	823	23.73 -	24.27	1.40*
65-69	22.70	314	21.65 -	23.74	23.41	550	23.10 -	23.71	0.71
70-74	21.65	200	20.70 -	22.60	22.75	348	22.48 -	23.02	1.10*
75+	20.11	214	19.60 -	20.62	21.27	360	20.92 -	21.62	1.16*
Total	**22.33**	**8623**	**22.05 -**	**22.61**	**23.78**	**20183**	**23.62 -**	**23.95**	**1.45***
Both									
15-19	20.13	1524	20.00 -	20.27	20.92	1213	20.63 -	21.22	0.79*
20-24	21.06	1482	20.83 -	21.29	22.14	1215	21.85 -	22.44	1.08*
25-29	21.58	1646	21.32 -	21.85	22.87	1525	22.56 -	23.17	1.29*
30-34	22.33	1792	22.05 -	22.61	23.57	2238	23.35 -	23.80	1.24*
35-39	22.68	1711	22.45 -	22.92	23.97	2735	23.73 -	24.21	1.29*
40-44	23.03	1426	22.67 -	23.38	24.32	2929	24.09 -	24.55	1.29*
45-49	23.17	1127	22.89 -	23.46	24.41	2811	24.16 -	24.67	1.24*
50-54	22.85	1082	22.26 -	23.43	24.37	2771	24.09 -	24.64	1.52*
55-59	22.10	953	21.66 -	22.53	24.12	2380	23.84 -	24.40	2.02*
60-64	22.11	823	21.67 -	22.56	23.35	5383	23.12 -	23.58	1.24*
65-69	22.23	550	21.32 -	23.15	22.82	5526	22.59 -	23.05	0.59*
70-74	20.99	348	20.33 -	21.64	22.26	4483	22.05 -	22.47	1.27*
75+	19.91	360	19.56 -	20.27	21.01	3775	20.76 -	21.26	1.10*
Total	**21.78**	**14824**	**21.55 -**	**22.01**	**23.20**	**38984**	**23.05 -**	**23.36**	**1.42***

* Significant (P-value <.05)

Table 16 Mean in age-specific body mass index in Thailand, 1992 and 2004

	NHES I (1992)					NHES III (2004)				
Male	**Bangkok**	**Central**	**North**	**Northeast**	**South**	**Bangkok**	**Central**	**North**	**Northeast**	**South**
15-19	19.75	19.76	19.42	19.94	19.35	22.29	21.09	20.83	20.53	20.01
20-24	20.68	20.73	20.58	20.73	20.78	21.90	22.35	22.05	21.91	21.38
25-29	20.44	20.92	21.37	21.16	20.80	21.24	22.87	22.80	22.24	22.12
30-34	22.73	22.09	21.09	21.75	21.34	23.08	23.87	22.67	22.79	22.42
35-39	22.62	22.47	21.28	21.91	22.06	25.27	23.58	22.81	22.99	22.81
40-44	23.07	22.43	21.81	22.03	21.59	24.29	24.20	22.84	23.28	23.20
45-49	24.42	22.62	21.27	21.61	21.90	23.92	24.02	23.06	23.42	23.64
50-54	22.81	22.38	20.74	22.39	21.61	24.97	24.14	23.09	23.12	23.48
55-59	24.02	21.46	21.31	21.58	21.93	23.49	23.96	22.93	23.08	22.71
60-64	22.86	22.05	19.91	20.93	21.21	23.74	23.35	21.21	21.71	21.57
65-69	23.67	22.50	20.62	21.58	21.67	24.18	22.71	21.92	22.47	22.41
70-74	21.87	20.07	19.91	21.38	19.57	23.26	22.24	21.53	21.87	21.91
75+	20.94	20.28	20.15	20.54	19.47	22.39	20.99	21.13	21.50	21.38
Total	**20.72**	**20.19**	**22.69**	**20.17**	**19.63**	**23.36**	**23.16**	**22.36**	**22.43**	**22.15**
Standardized	**22.26**	**21.62**	**20.85**	**21.37**	**21.09**	**23.39**	**23.19**	**22.37**	**22.45**	**22.18**
Female										
15-19	20.68	20.62	20.05	20.69	20.71	21.85	21.29	20.82	20.72	22.16
20-24	21.24	21.54	21.36	21.17	21.34	22.87	22.13	22.53	22.42	21.97
25-29	22.69	22.21	22.15	21.77	22.31	22.53	23.45	23.81	22.81	23.94
30-34	23.40	23.37	22.07	22.18	22.97	25.44	24.53	23.90	23.91	24.02
35-39	24.62	23.71	22.21	23.03	22.79	25.63	24.52	24.57	24.89	24.67
40-44	25.49	24.35	23.53	23.43	22.99	26.00	25.79	24.05	24.98	25.75
45-49	25.43	25.24	22.39	23.30	24.07	25.30	25.89	24.55	24.90	25.87
50-54	25.52	24.25	21.94	23.29	23.90	25.82	25.83	24.33	25.00	25.31
55-59	25.42	22.60	22.07	21.98	23.19	26.73	26.03	23.32	24.53	25.60
60-64	24.93	23.75	20.64	20.83	21.83	25.93	24.93	21.78	22.29	23.41
65-69	25.55	23.93	20.82	21.23	22.45	25.44	24.44	22.94	23.44	24.60
70-74	24.53	21.95	21.24	21.13	22.00	24.98	23.59	22.33	22.69	24.09
75+	22.81	19.87	20.64	21.22	21.49	23.54	22.07	21.84	22.14	23.38
Total	**22.01**	**21.28**	**20.32**	**20.57**	**20.80**	**24.72**	**24.23**	**23.32**	**23.50**	**24.03**
Standardized	**23.99**	**23.05**	**21.81**	**22.10**	**22.46**	**24.77**	**24.27**	**23.32**	**23.54**	**24.07**
Both										
15-19	20.21	20.20	19.73	20.31	20.06	22.07	21.19	20.82	20.62	21.04
20-24	20.97	21.12	20.98	20.95	21.08	22.38	22.24	22.29	22.17	21.67
25-29	21.59	21.57	21.77	21.48	21.59	21.91	23.16	23.30	22.52	23.04
30-34	23.10	22.74	21.60	21.97	22.18	24.33	24.21	23.29	23.35	23.22
35-39	23.65	23.12	21.76	22.49	22.44	25.47	24.07	23.71	23.94	23.75
40-44	24.31	23.41	22.69	22.74	22.31	25.21	25.03	23.46	24.13	24.50
45-49	25.00	23.96	21.84	22.45	22.97	24.67	25.01	23.82	24.17	24.79
50-54	24.35	23.33	21.37	22.85	22.78	25.43	25.04	23.72	24.09	24.43
55-59	24.75	22.06	21.71	21.78	22.56	25.24	25.06	23.13	23.83	24.22
60-64	23.97	22.94	20.29	20.88	21.29	24.96	24.20	21.52	22.03	22.57
65-69	24.63	23.27	20.72	21.40	21.84	24.89	23.64	22.45	22.98	23.55
70-74	23.32	21.13	20.60	20.89	21.84	24.27	22.99	21.96	22.32	23.09
75+	21.94	20.04	20.41	19.52	20.59	23.11	21.62	21.52	21.86	22.48
Total	**21.39**	**20.74**	**21.49**	**20.37**	**20.23**	**24.09**	**23.71**	**22.85**	**22.97**	**23.11**
Standardized	**23.17**	**22.35**	**21.34**	**21.75**	**21.79**	**24.13**	**23.75**	**22.85**	**23.01**	**23.14**

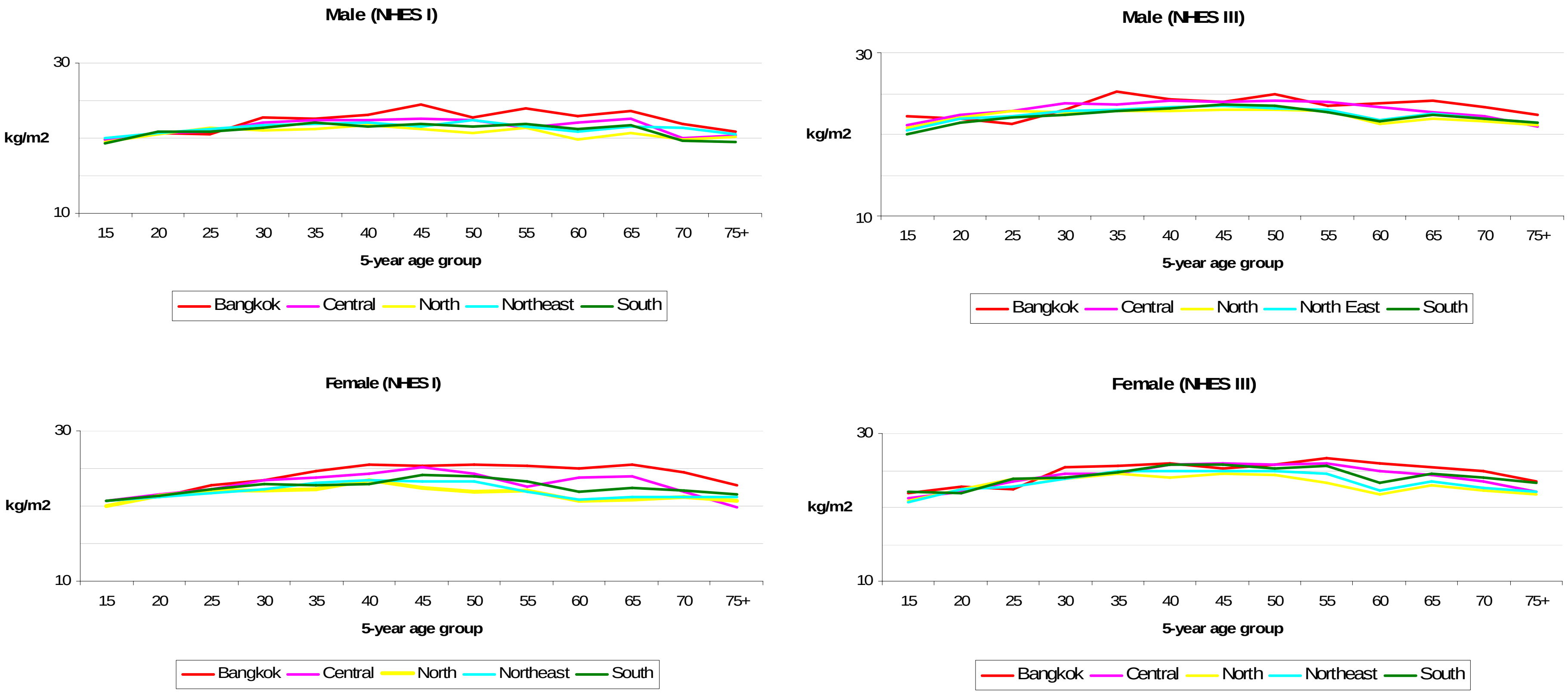


Figure 20 Mean in age-specific of body mass index by geographic region, 1992 and 2004

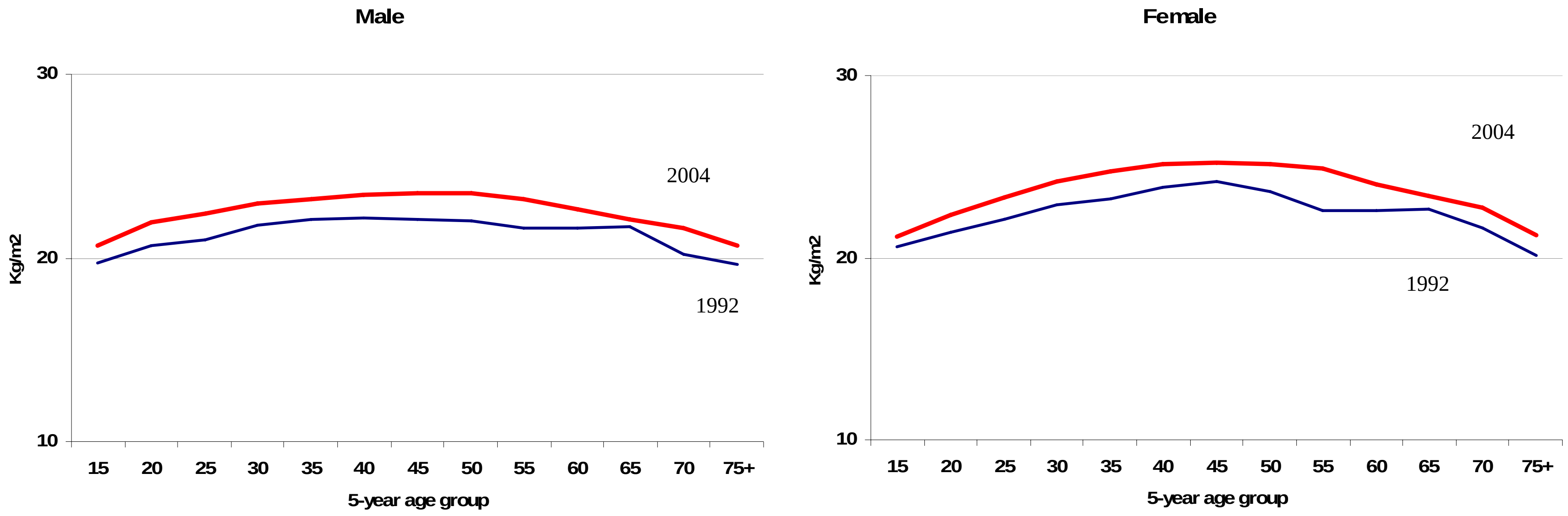


Figure 21 Mean in age-specific body mass index in Thailand, 1992 and 2004

Overweight, obesity, and body mass index

Overall, age specific and age-standardized overweight and obesity prevalence (($BMI \geq 25\ kg/m^2$, $BMI \geq 30\ kg/m^2$) tended to increase in males and females. A diiference across the two time periods for the population aged 15 and over was statistically significant ($P<0.05$).

The time trends of overweight and obesity prevalence seemed to be the same but the rates in females showed higher than males. The current finding also indicates that younger age had a higher prevalence of overweight and obesity prevalence. Excessive body mass during childhood and aldolescence was associated with an increased risk of becoming overweight in adulthood (Stunkard & Wadden, 1993; Whitaker, Wright, Pepe, Seldel, & Dietz, 1997) and with higher morbidity and mortality rates in adulthood (US Department of Health and Human Services, 1996).

Besides, overweight and obesity prevalence frequently affects the population aged 35 years and oveer. Similarly, trends in overweight and obesity have been experienced in other developing countries. The discrepancy and similarity in rates among these Asian countries might be due to certain factors including age structures, proportions of living in urban and rural communities, dietary pattern, culture and lifestyle.

Mean BMI also tended to increase among Thai population (from 21.38 to 22.63 kg/m^2 in males and from 22.63 to 23.84 kg/m^2 in females). A higher percentage of the children and adolescents were at risk of becoming overweight during this time. The finding indicated that childhood overweight was imposing an enormous health problem in Thailand. Although childhood overweight address from a public health perspective, a combination of diet and exercise as a method of weight control was underestimated or undervalued by the general overweight population. Possibly, campaign alone might not effective in encouraging people to lose weight. Comprehensive public programs involving children and parents should be tailored.

In part of regional difference in prevalence of obesity was observed in the present study. The higher prevalence of overweight and obesity in Bangkok and the central region compared with other regions might be related to environmental and socio-economic factors, including difference in diet, physical activity and culture. Because Bangkok and the central region were considered to be a more modernized areas compared with other regions (Aekplakorn et al., 2004). Differences in lifestyle related to obesity and overweight might be larger between central and peripheral regions disparity (Aekplakorn et al., 2004).

Overweight and obesity is one of the important risk factors for cardiovascular diseases and its complications. These findings suggested that overweight and obesity were emerging adverse health conditions among Thai population. Several studies have shown body weight to be related to functional disability moreover, obesity has been found to be associated with a greater risk lower-body and upper-body osteoarthritis, leading directly to disability. Obesity may also be indirectly associated with disability through diseases related weight status. Excess weight is associated with increased incidence of cardiovascular disease, type2 diabetes mellitus, and stroke. Heart disease has been associated with upper extremely and self-care tasks, and diabetes has been found to be a significant cause of mobility impairments. Particularly, numerous reports have also found significant relationships of BMI to health care costs (Daviglus, 2005). Aggregation of multiple risk factors, including obesity, high BP and hyperlipidaemia, has been shown to increase the development of coronary heart disease (Baltali et al., 2003; Marroquin et al., 2004; Solymoss et al., 2004). . In reality, the major causes of chronic diseases are known, and if these risk factors were eliminated, at least 80% of all heart disease, stroke and type 2 diabetes would be prevented; over 40% of cancer would be prevented (World health Organization, 2005).

Therefore, there wss the need to maintain a healthy weight by pursuing a healthy lifestyle—adopting healthy eating patterns and remaining or becoming physically active. This is because shift in health and nutritional status results in not only major direct medical care and drug costs but also results in increased disability, mortality, and sickness during the period of active labor force participation prior to retirement. The latter costs represent important drags on the economic system and are termed indirect economic costs. Ideally, the increasing prevalence of obesity is a threat for the public health as it related to several chronic morbidities and disability, implementation of new weight gain prevention programmes is urgently needed.

Strenght and limitations

The strength of this study is that it was used a representative sample of Thai population**.** The standardized anthropometric measurement and high-quality control of the study procedure substantially minimized the potential information bias. The limitation of the present study is that it is a cross-sectional design. More studies using prospective cohort explore more details about the age categories and anthropometric categories owing to the small sample sizes for many subgroups.

Conclusion: Trend in age-specific of chronic diseases and health parameters in Thailand, between 1992 and 2004

The finding confirmed the hypothesis that trends of the chronic diseases DM, HT, hypercholesterolemia, overweight, and obesity) and health parameters (FPG, TC, BMI) by aged-specific prevalence rates among the population has been increasing (table 17). Notably, overweight and hypercholesterolemia were the top rank should be improvement among Thai population (table18). A diiference age-standardized of chronic duiseases and health parameters across two surveys among the population aged 15 and over was statistically significant (P<0.05) (except hypertension).

Table 17 Difference in age-standardized of chronic diseases and health parameters in Thailand, 1992 and 2004

Male	NHESI	NHESII	Difference	P-value
Hypercholesterolemia (%)	27.72	37.03	9.31*	<0.05
Overweight (%)	12.94	22.82	9.88*	<0.05
Obesity (%)	1.55	4.80	3.25*	<0.05
Diabetes (%)	3.31	6.10	2.79*	<0.05
Hypertension (%)	21.42	23.75	2.33	NS
Total cholesterol (mg/dl)	178.89	189.42	10.53*	<0.05
Fasting plasma glucose (mg/dl)	86.75	94.98	8.23*	<0.05
Body mass index (kg/m²)	21.37	22.62	1.25*	<0.05
Female				
Hypercholesterolemia (%)	36.85	43.78	6.93*	<0.05
Overweight (%)	23.71	34.90	11.19*	<0.05
Obesity (%)	5.45	9.13	3.68*	<0.05
Diabetes (%)	3.82	7.46	3.64*	<0.05
Hypertension (%)	20.80	21.52	0.72	NS
Total cholesterol (mg/dl)	189.32	198.16	8.84*	<0.05
Fasting plasma glucose (mg/dl)	87.34	93.30	5.96*	<0.05
Body mass index (kg/m²)	22.59	23.82	1.23*	<0.05
Both sexes				
Hypercholesterolemia (%)	32.39	40.48	8.09*	<0.05
Overweight (%)	18.45	29.01	10.56*	<0.05
Obesity (%))	3.54	7.01	3.47*	<0.05
Hypertension (%)	21.08	22.60	1.52	NS
Diabetes (%)	3.55	6.80	3.25*	<0.05
Total cholesterol (mg/dl)	184.24	198.31	14.07*	<0.05
Fasting plasma glucose (mg/dl)	87.03	94.11	7.08*	<0.05
Body mass index (kg/m²)	22.00	23.24	1.24*	<0.05

* = significant P-value<0.05, NS= no significant

Table 18 Percent of difference in prevalence of chronic diseases and health parameters mean in Thailand, 1992 and 2004

	Percent of difference					Mean of difference		
Male	**OVW**	**HCL**	**HT**	**OBS**	**DM**	**TC**	**FPG**	**BMI**
15-19	6.20*	3.02	-2.00	2.88*	0.80	6.86*	3.33*	1.01*
20-24	8.70*	9.03*	-4.10	5.68*	0.70	3.36	3.61*	1.25*
25-29	12.60*	8.78	3.90	4.53*	0.00	12.38	4.87*	1.45*
30-34	10.90*	12.01*	-3.80	3.12*	-0.30	13.65*	6.15*	1.22*
35-39	7.10*	4.63*	-1.00	2.27*	3.50*	7.73	8.33*	1.07*
40-44	10.90*	18.06*	3.90	3.08*	3.30*	16.68*	10.12*	1.31*
45-49	12.00*	8.76	5.80	1.88	4.70*	10.33*	11.28*	1.42*
50-54	14.90*	8.31*	4.60	4.70*	6.60*	12.53*	15.94*	1.51*
55-59	12.10*	12.36*	11.80*	4.46*	7.30*	12.28*	15.70*	1.63*
60-64	10.00*	9.38	12.40*	1.15*	2.50	11.23	6.73	1.03*
65-69	2.60*	16.22*	-1.10	-	3.40	14.89*	10.76*	0.42
70-74	10.50*	-4.38	1.20	-	5.60*	0.22	6.55	1.46*
75+	3.00	11.98	21.00*	-	8.00*	12.76	11.74*	1.02*
Total	**11.30***	**12.12***	**4.80**	**3.48***	**3.10***	**13.32***	**8.65***	**1.40***
Female								
15-19	7.10*	-4.55	0.20	3.21*	1.10	-2.33	2.64*	0.58*
20-24	12.20*	3.00	-3.60	4.13*	0.80	4.81	3.32*	0.93*
25-29	10.00*	2.10	-5.60	5.01*	1.30*	6.02	3.30*	1.15*
30-34	11.10*	7.55	-4.60	2.93	1.50*	10.18	3.54*	1.28*
35-39	12.60*	10.05*	-0.90	4.96*	0.30	9.52*	4.90*	1.51*
40-44	11.70*	11.32*	1.10	4.18	3.20*	14.49*	6.55*	1.28*
45-49	11.80*	7.09	1.70	1.93	1.20	10.33*	3.16*	1.03*
50-54	12.00*	14.26*	-0.90	5.76*	5.80*	12.69*	10.30*	1.51*
55-59	18.90*	15.95*	8.70	7.11*	10.40*	16.76*	9.66*	2.37*
60-64	9.70*	6.95	5.80	0.55	15.90*	6.08	17.41*	1.40*
65-69	7.20*	8.51	10.30*	-	10.30*	13.48*	9.24*	0.71
70-74	7.20*	5.17	-1.80	-	9.00*	8.60	10.91*	1.10*
75+	10.00*	4.51	23.50*	-	7.20*	6.62	8.67*	1.16*
Total	**13.90***	**9.35***	**4.30**	**4.42***	**4.30***	**11.59***	**8.63***	**1.45***
Both sex								
15-19	6.60*	-1.07	-0.86	3.06*	0.93	1.86	3.02*	0.79*
20-24	10.40*	6.10	-3.89*	4.91*	0.71	4.09	3.42*	1.08*
25-29	11.10*	5.35	-0.85	4.73*	0.71	9.10	4.09*	1.29*
30-34	10.90*	9.76*	-4.16	2.97*	0.65	11.88*	4.82*	1.24*
35-39	9.90*	7.44*	-0.94	3.62*	1.83	8.67*	6.57*	1.29*
40-44	11.40*	14.64*	2.42	3.65*	3.32*	15.57*	8.29*	1.29*
45-49	12.10*	7.95	3.73	1.96	2.94*	10.39	7.15*	1.24*
50-54	13.50*	11.48*	1.75	5.27*	6.27*	12.78*	13.05*	1.52*
55-59	15.70*	14.29*	10.19*	5.86*	9.01*	14.69*	12.57*	2.02*
60-64	10.00*	8.24	9.01*	0.87	9.52*	8.67	12.34*	1.24*
65-69	5.20*	12.36	4.97	-	7.07*	14.38	9.98*	0.59*
70-74	8.80*	1.00	-0.49	-	7.54*	4.99	8.96*	1.27*
75+	7.00*	7.67	22.44*	-	7.53*	7.11	9.94*	1.10*
Total	**12.60***	**10.71***	**4.51**	**3.96***	**3.73***	**12.45***	**7.92***	**1.42***

* Significant P< .05, OVW= overweight, HCL= hypercholesterolemia, OBS= obesity, HT= hypertension, DM= diabetes, TC= total cholesterol, BMI= body mass index

4.2 Disability

The presentation of the results is divided into two parts. Firstly, trends in prevalence of disability among elderly were described. Finally, trends in age-specific ADL disabilities were illustrated.

4.2.1 Trends in prevalence of ADL disabilities among elderly in Thailand, 2002-2007

Table 19 showed trends in age specific and age-standardized disability rates in Thailand, 2002-2007. The overall prevalence of disability among age 60+ years in Thailand showed upward trend across the five-year period ranking from 3.33% in 2002 to 4.20% in 2007. In other words, the rate of disability increased around 2 % in 5-years.

For each year, disability rates increased with age and peaked at age-group 90+ years for males and females (see also Figure22). Elderly women had higher prevalence rates of ADL disabilities in nearly all age groups compared to elderly men. ADL disability prevalence also increased with age both sexes. These patterns were similarly at the same period. The rate increases from 2.77% to 3.51% in males and from 3.77% to 4.73% in females over this time.

Table 19 Prevalence rates (%) of ADL disabilities in the elderly, by age and sex, 2002 and 2007

	Male		Female		Total	
Age group	**2002**	**2007**	**2002**	**2007**	**2002**	**2007**
60-69	1.35	1.82	1.28	1.56	1.37	1.83
70-79	3.00	3.62	3.67	4.15	3.22	4.01
80-89	7.51	10.10	10.10	14.15	9.52	11.89
90+	20.45	24.29	25.70	35.52	26.97	32.81
Total	**2.44**	**3.55**	**3.52**	**4.70**	**2.87**	**3.77**
Standardized	**2.77**	**3.51**	**3.77**	**4.73**	**3.33**	**4.20**

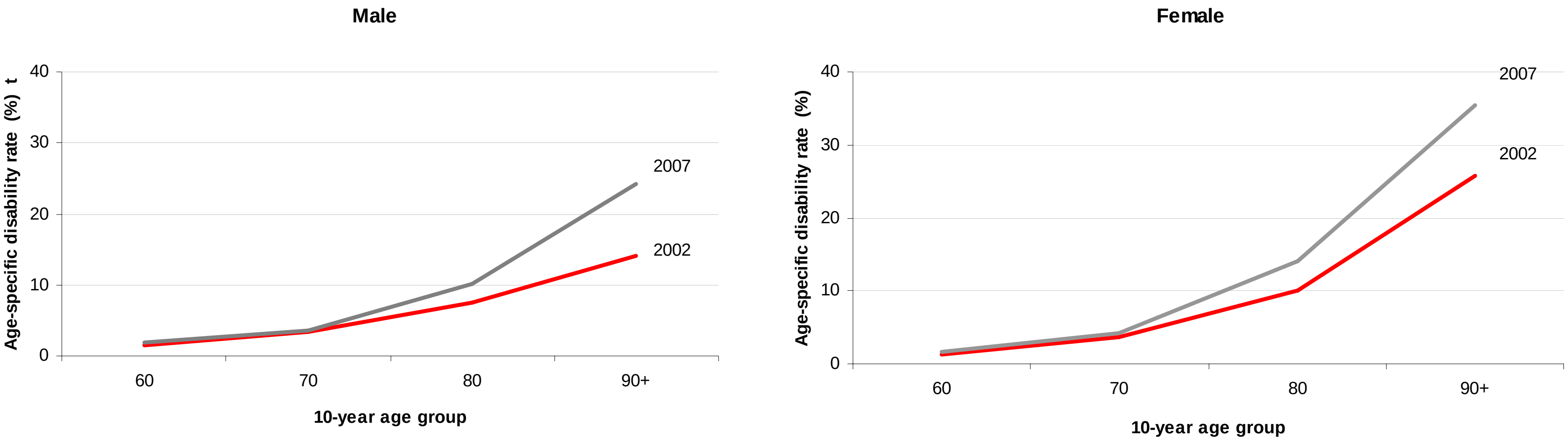


Figure 22 Prevalence rates (%) of ADL disabilities in the elderly, by age and sex, 2002 and 2007

Table 20 also presented disability rates increased with age and peaked at age-group 90+ years for males and females over this period. Across each age group 70-80+, disability prevalence tend to increase in males and females. The prevalence of disability differed by region. In 2007, Bangkok has the highest prevalence of disability (5.62% in males, 7.60% in females) followed by the Central (4.62% in males, 5.41% in females), the South (4.02% in males, 4.77% in females), the Northeast (2.81% in males, 3.39% in females), and the North (2.31% in males, 3.89% in females) (see also Figure 23)

Table 20 Regional differentials in ADL disability in Thailand, 2002 and 2007

		2002			2007		
		Male	**Female**	**Total**	**Male**	**Female**	**Total**
Bangkok	**60-69**	1.93	2.18	2.06	4.48	2.42	3.35
	70-79	2.59	3.47	3.08	5.71	6.52	6.20
	80-89	16.22	14.86	15.29	12.93	27.63	22.31
	90+	50.75	25.86	32.93	10.12	57.25	42.06
	Total	**3.19**	**4.06**	**3.67**	**5.50**	**7.13**	**6.43**
	Standardized	**4.24**	**4.44**	**4.28**	**5.62**	**7.60**	**6.84**
Central	**60-69**	1.28	0.87	1.06	2.63	1.76	2.16
	70-79	2.86	4.63	3.84	5.12	4.25	4.62
	80-89	6.81	12.16	10.01	9.54	15.88	13.54
	90+	17.14	43.26	34.10	31.09	49.00	43.06
	Total	**2.38**	**3.90**	**3.21**	**4.22**	**4.75**	**4.52**
	Standardized	**2.61**	**4.50**	**3.66**	**4.62**	**5.41**	**5.09**
North	**60-69**	1.36	1.38	1.37	1.06	1.07	1.07
	70-79	3.88	3.70	3.79	2.35	4.18	3.35
	80-89	5.12	11.08	8.81	6.51	11.17	9.14
	90+	8.90	14.56	12.57	20.02	29.19	25.62
	Total	**2.42**	**3.10**	**2.78**	**2.12**	**3.44**	2.82
	Standardized	**2.70**	**3.57**	**3.20**	**2.31**	**3.89**	**3.16**
Northeast	**60-69**	1.27	1.47	1.38	1.58	1.48	1.53
	70-79	2.29	2.45	2.38	2.52	3.07	2.83
	80-89	7.58	7.17	7.33	9.37	10.40	10.00
	90+	13.35	26.74	20.76	24.60	31.22	28.90
	Total	**2.05**	**2.42**	**2.25**	**2.56**	**3.09**	**2.85**
	Standardized	**2.25**	**2.79**	**2.54**	**2.81**	**3.39**	**3.14**
South	**60-69**	1.19	1.50	1.35	2.02	2.37	2.21
	70-79	3.61	2.42	2.99	4.03	6.54	5.45
	80-89	6.73	10.48	8.82	8.25	11.17	10.05
	90+	40.86	34.37	36.76	24.17	29.56	27.77
	Total	**2.85**	**3.23**	**3.05**	**3.47**	**5.30**	**4.48**
	Standardized	**3.58**	**4.12**	**3.88**	**3.91**	**5.89**	**5.02**

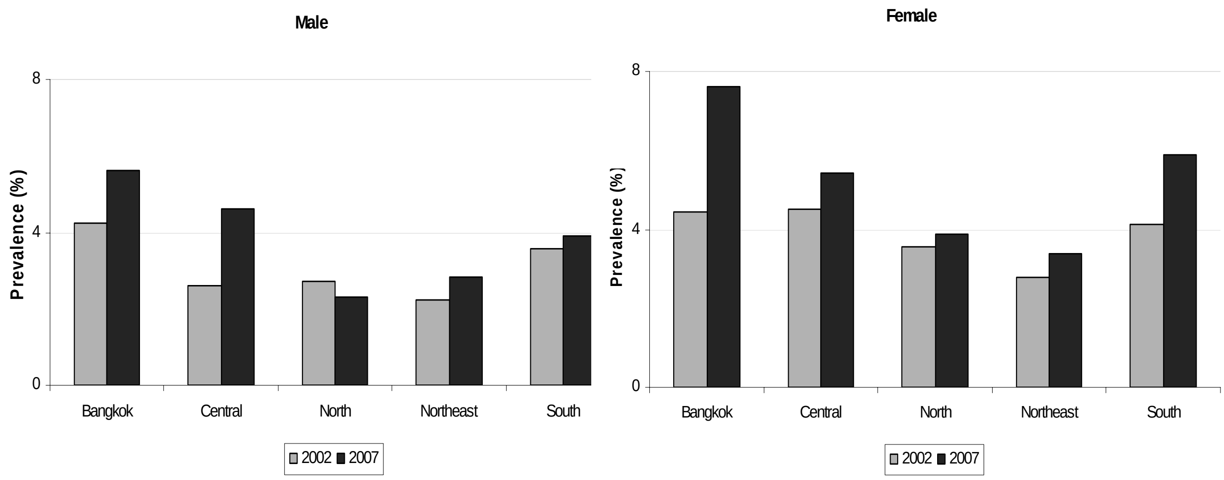


Figure 23 Prevalence rates (%) of ADL disabilities in the elderly, by geographic region and sex in Thailand, 2002 and 2007

4.2.2 Trends in age specific and age-standardized disability rate by types of ADL disabilities, 2002-2007

Table 21 and Figure 24 displayed trends in age-specific and age-standardized specific ADL disabilities, between 1997and 2007. The overall prevalence of specific ADL disabilities among age 60+ years in Thailand showed upward trend across the five-year period. There were inclines in difficulty with eating (1.34%VS 2.51%), dressing (2.41% VS 3.38%), bathing and toileting (3.25% VS 3.78%) for both sexes. Elderly females had higher prevalence rates of specific ADL disabilities in nearly all age groups compared to elderly males. In 2007, the prevalence of ADL restrictions was highest in bathing/ toileting (3.78%), follows by dressing (3.38%), and eating (2.51%) for both sexes. It was also found that the prevalence of ADL disabilities in all types increased with age in both sexes. These patterns were consistent for both sexes.

Table 21 Prevalence rates (%) of ADL disabilities among elderly, by type, age and sex, 2002-2007

Type of ADL	Male		Female		Total	
Disabilities	2002	2007	2002	2007	2002	2007
Eating						
60-69	0.55	1.24	0.54	0.82	0.54	1.01
70-79	1.35	2.49	1.14	2.78	1.24	2.65
80-89	3.07	5.72	4.64	7.54	4.03	6.83
90+	8.95	14.95	12.07	21.56	10.93	19.26
Total	**1.03**	**2.09**	**1.25**	**2.39**	**1.15**	**2.26**
Standardized	**1.18**	**2.28**	**1.46**	**2.69**	**1.34**	**2.51**
Dressing						
60-69	1.23	1.57	0.80	1.23	1.00	1.39
70-79	2.77	3.10	2.21	3.53	2.47	3.35
80-89	4.47	7.06	7.88	10.94	6.55	9.42
90+	13.53	18.29	21.55	31.98	18.56	27.25
Total	**2.01**	**2.61**	**2.13**	**3.35**	**2.08**	**3.02**
Standardized	**2.23**	**2.85**	**2.53**	**3.78**	**2.41**	**3.38**
Bathing/toileting						
60-69	1.32	1.59	1.37	1.58	1.35	1.59
70-79	2.90	3.27	3.30	3.89	3.12	3.62
80-89	7.08	7.89	10.43	12.88	9.12	10.92
90+	19.49	22.22	31.43	33.64	27.07	29.70
Total	**2.34**	**2.78**	**3.17**	**3.87**	**2.79**	**3.38**
Standardized	**2.66**	**3.06**	**3.71**	**4.34**	**3.25**	**3.78**

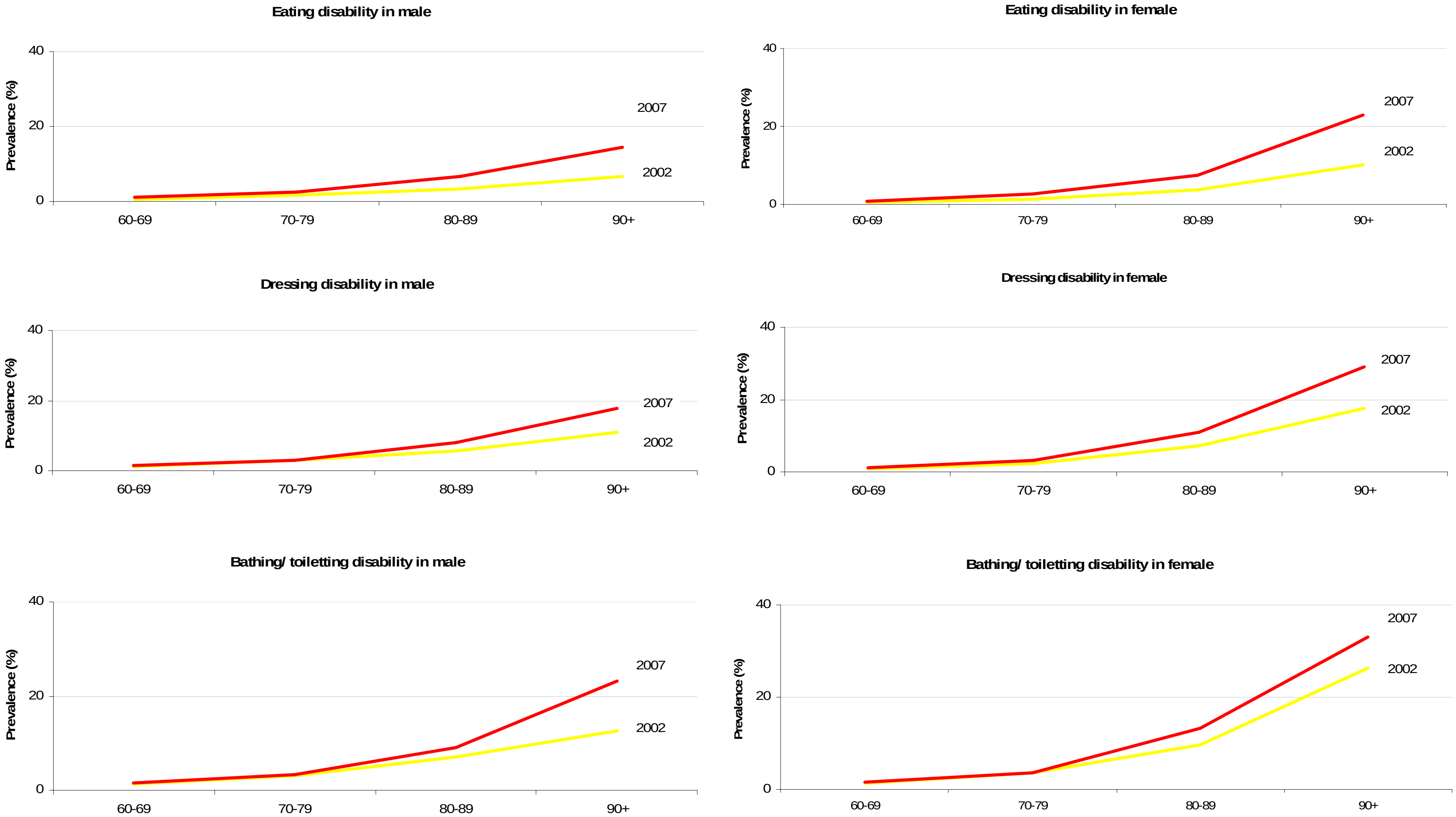


Figure 24 Percent of ADL disabilities by type in Thailand, 2002-2007

Discussion

This study attempted to find further empirical evidence concerning the question of whether trends of the ADL disabilities by aged specific rates among Thai population has increased. This study concluded that trends in ADL disabilities among Thai population have increased (2%) for both sexes over 5-year. As age increased, prevalence of disability also becomes greater. These are (a) older people have greater risks of becoming disabled because they were more likely to have more chronic conditions (Porapakkham & Bunyaratpun, 2004) (b) activity limitations often first appear later in life, but risk factors for such limitations and underlying chronic conditions and impairments may be traced to behaviors and exposures earlier in life (Vicki A. Freedman, Martin, Schoeni, & Cornman, 2008).

Moreover, the prevalence of ADL disabilities such as eating, dressing, bathing and toileting increased after age 60 and above. The elderly women were worse than that of elderly men which the most problematic was bathing/toileting disability. This is because women tend to live longer than males at each level of impairment, so that the prevalence of women with disability will be greater (Manton & Stallard, 1991)

It is noted that the prevalence of disability differed by region. Bangkok has the highest prevalence of disability (6%). These finding may be resulted from the combination of several factors such as shift in health, nutritional status results, an access to health care, environment factors and socioeconomic development, which affected mortality and disability of the elderly living in different regions (Cutler, 2001; Wolf, 2001).

In fact, the prevalence of disability is affected by changes in both morbidity and mortality. Obviously, results from the first and the third National Health Examination Surveys (Chuprapawan, 1991; Porapakkham & Bunyaratpun, 2004) indicated upward trends of chronic diseases and heath parameters among Thai population age 40 and above over this time. For example: among the prevalence of diabetes, hypertension, hypercholesterolemia, overweight, and obesity have increased from 4% to 7%, 21% to 22%, 32% to 40%, 18% to 29%, and 3% to 7% respectively, during 1992 to 2004. The prevalence of overweight and obesity among children and adolescents has also increased dramatically (Chuprapawan, 1991; Kosulwat, 2002; Porapakkham & Bunyaratpun, 2004).

Particularly, cardiovascular diseases, hypertension, diabetes mellitus and cancers in-patients rates which admitted in MOPH hospital in Thailand (except total hospitals in Bangkok) (Ministry of Public Health, 1998, 2000, 2002, 2006), it was found that the increase rates by each year of illness rates in chronic diseases sharply increased from 1998 to 2000 and the rates tend to increase in later years. Similarly, mortality data showed the rising prevalence of ischemic heart disease, cancer among age 60 and above but the speed and mortality rate occurred in older and level off in later years. Interestingly, mortality data of cerebrovascular disease sharply increased from 1998 to 2004 and the rates tend to drop in 2006. This is also surprising because mortality data of DM, HT have decrease since 2000 (Ministry of Public Health, 1999, 2001, 2002, 2004, 2005c, 2006, 2007b). It would mean there has been increased survival of those with limitations at least 7 years since the mortality decline was attributable to lower death rates from chronic diseases (especially heart disease and stroke), made the view popular in some groups that increased longevity had led to increased frailty in the surviving elderly population (Gruenberg, 1977; Olshansky & Ault, 1986). These results agree with the present finding that the prevalence of disability has increased over 5 year.

Understanding changes in functional disabilities is also important for the Thai health care service system, because older persons with functional disabilities tend to have higher per capita acute and chronic health care costs than their non-disabled counterparts (Manton & Stallard, 1996). In other words, reduction or increase in disability at late life may have imperative direct and indirect effects on future health care expenditures. Policy steps are needed to adequately prepare for the growing number of disabled elderly. Besides, these findings have important implications for health and long-term care programs and could be used to project the proportion of the disabled population in the coming decades.

Thus, there are clear upward trends in the percentage of the elderly population in Thailand who are disabled over 5-year. Possibly, the number of disability will continue to plague those who survive to older ages. Although the small portion (2%) of those who faced these problems deserve some attention, these functions are considered essential for survival in the society. In addition, this survey covered only people that reside in the community. If the resident in the institutions and all kinds of disabilities are included, this figure would have been higher.

Strengths and limitations

Since there is no agreement on the definition and measurement of disability, the definition of disability in this study was the restriction in ADL, which included only four activities. This is due partly to availability of data. Including these data was that they did not include the people living in institutions so the underestimation of nuber of disability should consider. Despite these limitations, a clear strength of the study is the large sample sizes which can nationally representative survey of Thai elderly population. Additionally, questions on activities were introduced in SET between 2002 and 2007 have almost the same set of ADL question. Prevalence of

ADLs disability in this study would reflect the minimum prevalence of disability of self care among Thai elderly population.

Conclusions

The present finding confirms the hypothesis that trends of the ADL disabilities by aged specific rates and age-standardized among the population has been increasing.

4.3 Mortality

The content in this chapter obtained the results and discussion from the study according to objectives stated in chapter I. The presentation of the results was trends in age specific mortality rates of the chronic diseases among the population which classified by ICD-10.

4.3.1 Trends in age-specific mortality rates from ischemic heart disease (I20-I25): 1998-2006

The finding showed two major issues—trends in age-specific and age-standardized mortality rates for IHD in Thailand: 1998-2006 as follows:

Table 22 showed trends in age specific mortality rates from IHD in Thailand: 1998-2006. Across each age-group 0-39 by year, IHD mortality rate revealed inconsistent trends for both sexes. It began to increase from the age of 40 onwards for males and females (see also Figure25). For each year, IHD mortality rates increased with age and peaked at age-group 75-84 for males and females. In 2006, the highest mortality rates were 296 and 239 for male and female, respectively. Across each age-group by year, IHD mortality rates sharply increased from 1998 to 2000 and the rates tend to level off in later years for males and females. Unexpectedly, there was slightly dropped in age groups 45-69 for females between 2004 and 2006.

Figure 26 displayed similarly the time trends of IHD mortality in both sexes but the rate in males showed higher than in females. Age-standardized mortality rates for IHD increased from 5.68 to 22.89 per 100,000 males and 3.80 to 18.13 per 100,000 females. In other words, total mortality rates for IHD increased at least fourfold in 8 years for both sexes.

Discussion

Overall, age specific and age-standardized IHD mortality trends have been increased in both sexes. The time trends of IHD look similarly but the rates in males showed higher than female. Most of these change due to classic coronary risk factors—hyperlipidaemia, diabetes mellitus, high blood pressure, obesity, and smoking (Dockery, Pope, Xu, & et al, 1991; Kuulasmaa, Tunstall-Pedooe, Dobson, & et al, 2000; Morris, Whincup, Lampe, & et al, 2001; Tunstall-Pedoe, Vanuzzo, Hobbs, & et al, 2000). However, improvements in risk factors and/or health interventions may lead to decreases in burden for IHD. The author summarized possible explanations that associated by age group as follows.

Across each age-group 0-39 by year, IHD mortality rate revealed inconsistent upward trends for both sexes. There may be misclassification aged 0-14 among men and women, and the under-registration of infant deaths. This is because registration is not a reliable source or mortality data for this very young age group (Prasartkul & Vapattanawong, 2006). The rate is also inconsistency in men and women at aged 15-39. The reason for inconsistency is unclear. There may be misclassification (Prasartkul & Vapattanawong, 2006). The prevalence of overweight and obesity among children and adolescents has also increased dramatically during this period (Chuprapawan, 1991; Kosulwat, 2002; Porapakkham & Bunyaratpun, 2004). Thai people would be excessive consumption of caloric sweeteners and large amounts of soft drinks and fruit drinks; however, this is certainly not the case (Ministry of Public Health, 2005b). Teenagers prefer western foods to local or Thai food (Ministry of Public Health, 2005d). Consuming food rich in fat and calories is a risk factor of cardiovascular disease (Ministry of Public Health, 2005d). Technological shifts have reduced physical activity at work, travel, home production, and leisure. Its effect may have a high risk for IHD death in younger age group among males and females. However, it needs to further investigation.

In part, trends in age specific mortality rates for IHD began to increase from the age of 40 onwards for males and females. This might be explained by starting of IHD morbidity in Thai people of age 30 year and over (Ministry of Public Health, 2005c). Thereafter, it showed disease effect until some time later.

The rising incidence of IHD morbidity among middle age and older (Ministry of Public Health, 2005c) is very likely to have made a major contribution to the increase in IHD mortality rates by increasing with age and peaked at age-group 75-84 from 1998 to 2006. This finding concurs with comparison the evidence from National Health Examination Survey (NHES) I, II, and III (1992, 1997, and 2004) showed total cholesterol level, hypertension, and type2-diabetes mellitus were increasing among middle age and older age group for both sexes (Chuprapawan, Porapakkham, & et al, 2000; Porapakkham & Bunyaratpun, 2004; Thailand Health Research Institute, 1997). Especially, an analysis of risk factors for cardiovascular diseases among Thai population aged 35-59 revealed a rising prevalence of people with high blood cholesterol, high blood sugar, overweight and obesity both sexes(Ministry of Public Health, 2005d). Besides it was found that Thai people tend to consume more sugar and food prepared from flour and sugar. The sugar consumption rate during the past two decades has risen two-to four-fold, from 12.7 kg/person/yr in 1983 to 30.5 kg/person/yr in 2003 (Ministry of Public Health, 2005d). Including there was a marked increase in consumption of energy-rich food (such as fast food), a decrease in energy expenditure (through less physical activity and sedentary lifestyle), and loss of traditional social support mechanisms (Petcharoen, Prasartkul, Gray, & Vapattanawong, 2006). Several studies (Jitapunkul, 1999, 2000; Petcharoen et al., 2006; Porapakkham & Bunyaratpun, 2004) also indicated increase in poor behaviors related cardiovascular disease risk factor and mortality. Likewise in developed countries were found IHD death rates are higher for men than women (Mathers et al., 2003).

Moreover, another possible explanation might be due to an increasing age of the population (Oxfordshire Community Stroke Project, 1983; Robins & Baum, 1981) because increasing risk are higher percent after age 60 or above(World health Organization, 2005). Indeed, IHD has become the more frequent cause of death in the older age groups (World health Organization, 2005). As mortality from IHD is strongly related to age, the increase in the Thai population aged 60 years and older from 7.36 percent in 1990 to 10.7 percent in 2007 (National Statistical Office, 1994, 2008) might have been expected to precipitate an increase in absolute number of death from IHD. The proportion of the population aged 60 years or over is expected approximately to double in 2020 (Aekplakorn et al., 2008). If so, the number of death will increase to around 65% (Ministry of Public Health, 2005c).

In this study, changes in IHD mortality were clearer for the older than the younger groups for both sexes. The sex-specific death rates due to IHD from 1998 to 2006 indicated IHD mortality rates in men have more than women among middle age and older. Interestingly, the evidence from NHES I, II, and III (1992, 1997, and 2004) tend to increase and that most risk factor incidence of IHD among middle age and older age group among females is higher than males (Chuprapawan, 1991; Porapakkham & Bunyaratpun, 2004; Thailand Health Research Institute, 1997). It was likely people living in developing countries not only face lower life expectancies (higher risk of premature death) than those in developed countries but also live a higher proportion of their lives in poor health (Mathers et al., 2003). Illnesses among the disabled revealed that coronary-artery disease was most common. It is noted disability might be occur among Thai people. Thai studies (Jitapunkul, 1999; Rakchanyaban, 2002) also found Thai women are more at risk of developing disability than Thai men. However, this point needs to further investigation.

Obviously, compared with the IHD in-patients rates which admitted in MOPH hospital in Thailand (except total hospitals in Bangkok) (Ministry of Public Health, 1998, 2000, 2002, 2006), the author found the increase rates by each year agreed with IHD mortality rates sharply increased from 1998 to 2000 and the rates tended to level off in later years.

Perhaps campaign on health promotion throughout Thailand, campaign on exercise for health, promotion of health food consumption, campaign on non-smoking, and effective treatment should have lengthened affected survivals of patient during this time. The MOPH has launched campaigns to raise public awareness about the prevention and control of cardiovascular diseases, particularly hypertension in normal and at-risk conditions to reduce the risk of paralysis and heart diseases (Ministry of Public Health, 2005a). This would possibly increase the period in which competing cause of death. This is likely to explain why across each age-group by year, IHD mortality rates sharply increased from 1998 to 2000 and the rates tended to level off in later years for males and females. Although this might indicate that the public health sector has done enough to heath lifestyles and modify behavior risk, it indicates that there remains a gap in translating knowledge into policy actions. Particularly, disability might be occurring among Thai people. It will affect the estimated problems and need of Thai population in the future. It is of crucial policy importance because it affects health and long-term care needs of Thai population.

Strenght and limitations

This study based on vital statistics for giving only picture of trends in age-specific mortality rate. In using the results, users should keep in mind that (a) underestimation of mortality rates from ischemic heart disease was inevitable if mortality data were used (b) systematical biases of mortality records existed during coding could be considered as incomplete death-reporting information (Ministry of Public Health, 1998, 2000).

Conclusions

Overall mortality trends from IHD have been increasing during 1998-2006 for both sexes. Changes in IHD mortality were clearer for the older than the younger generations. Death is inevitable, but a life of protracted ill-health is not (World health Organization, 2005). IHD prevention and control helps people to live longer and healthier lives. There still remains a gap in translating knowledge into policy actions. Thailand should increase its effort in controlling and reducing the coronary risk factors by promoting healthy behaviors such as physical activity and healthy diets.

Table 22 Trends in age specific mortality rates from ischemic heart disease: 1998-2006, Thailand (per 100,000)

Age	Males					Females					Both Sexes				
Group	1998	2000	2002	2004	2006	1998	2000	2002	2004	2006	1998	2000	2002	2004	2006
0-4	0.93	0.73	0.59	0.00	0.15	0.60	0.78	0.05	0.00	0.21	0.77	0.75	0.33	0.00	0.18
5-9	0.15	0.11	0.08	0.04	0.04	0.15	0.04	0.41	0.00	0.00	0.15	0.07	0.24	0.02	0.02
10-14	0.14	0.11	0.24	0.00	0.04	0.04	0.07	0.00	0.00	0.04	0.09	0.09	0.12	0.00	0.04
15-19	0.10	0.42	0.16	0.33	0.21	0.14	0.32	0.16	0.04	0.17	0.12	0.37	0.16	0.19	0.19
20-24	0.51	0.86	0.61	0.74	0.82	0.25	0.60	0.07	0.08	0.24	0.38	0.74	0.34	0.41	0.53
25-29	1.92	2.13	1.39	1.65	1.24	0.59	0.81	0.18	0.51	0.37	1.27	1.48	0.79	1.08	0.81
30-34	2.20	4.31	3.26	3.00	3.09	0.51	1.20	0.44	0.90	0.79	1.36	2.77	1.83	1.95	1.93
35-39	3.02	6.02	5.63	6.85	5.56	0.59	1.66	0.63	1.80	1.71	1.80	3.82	3.09	4.28	3.60
40-44	3.40	8.32	10.87	11.42	11.87	1.46	3.25	1.25	3.50	3.61	2.42	5.77	5.97	7.38	7.64
45-49	6.47	14.31	18.55	20.57	22.42	1.88	5.31	3.59	7.77	7.57	4.13	9.72	10.84	13.97	14.76
50-54	7.99	20.76	28.12	33.61	34.64	3.42	9.50	7.44	14.77	13.03	5.64	14.98	17.44	23.82	23.37
55-59	13.72	29.88	45.33	55.72	56.52	5.64	16.11	16.59	24.50	24.39	9.52	22.69	30.43	39.45	39.68
60-64	21.07	47.48	64.58	75.36	84.76	8.63	27.75	23.59	40.31	44.60	14.51	37.06	43.01	56.88	63.53
65-69	24.93	72.97	95.83	123.72	116.68	13.96	47.33	46.60	75.26	74.34	19.06	59.24	69.27	97.55	93.80
70-74	32.00	107.38	150.93	168.13	169.40	22.14	77.08	90.39	116.67	122.40	26.67	90.90	117.40	139.58	143.26
75-79	53.50	159.40	190.78	213.04	244.64	41.16	114.26	154.38	161.53	181.61	46.58	134.24	170.00	183.56	208.48
80-84	62.22	189.70	244.48	263.22	295.74	55.12	141.26	232.58	205.78	238.86	58.07	161.54	237.44	229.31	262.02
85+	45.91	162.42	188.51	273.45	294.17	31.62	141.89	188.71	222.99	251.54	37.31	150.13	188.63	242.53	267.98
Crude rate	**4.58**	**12.03**	**17.08**	**20.88**	**22.73**	**2.62**	**8.24**	**10.90**	**14.58**	**16.20**	**3.60**	**10.12**	**14.01**	**17.70**	**19.42**
Adjusted rate[a]	**5.65**	**14.54**	**18.62**	**21.97**	**22.89**	**3.80**	**11.65**	**12.92**	**17.10**	**18.13**	**4.83**	**13.36**	**16.22**	**19.93**	**20.92**

[a] Per 100,000 people by sex adjusted to standardization national population 2007

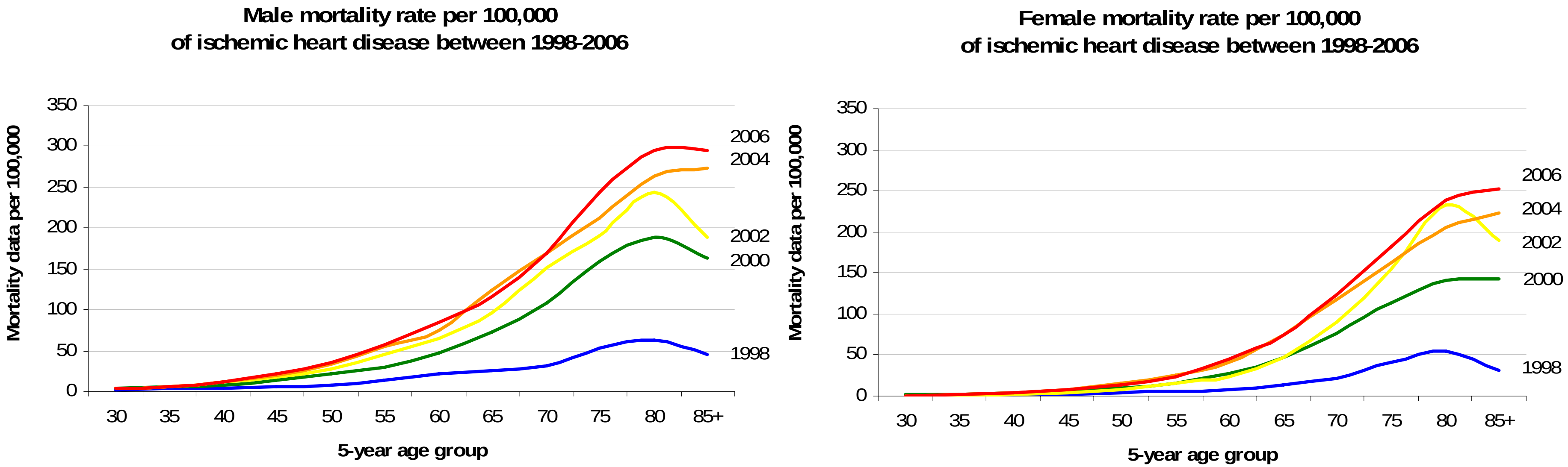


Figure 25 Trends in age-specific mortality rate of ischemic heart disease, 1998-2006

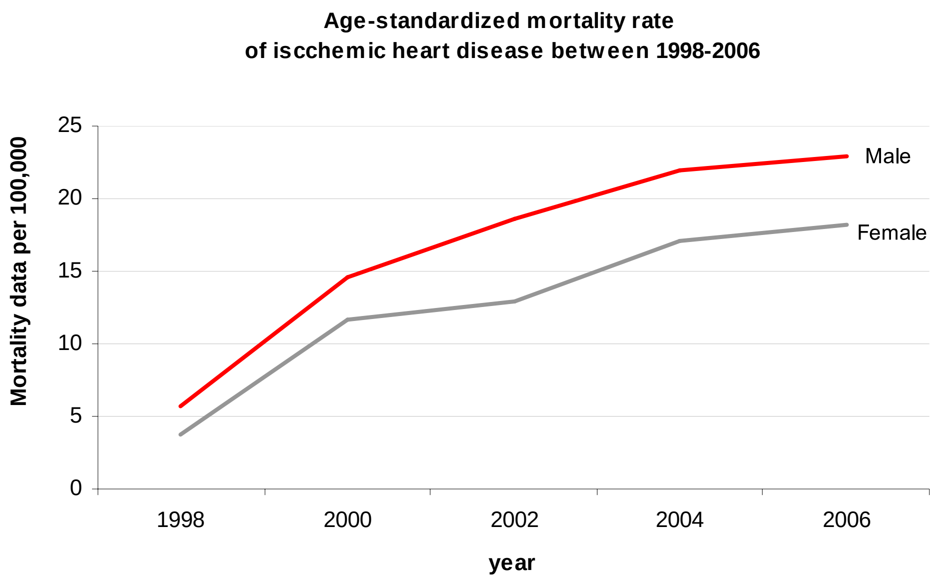


Figure 26 Mortality trends of ischemic heart disease, 1998 - 2006

4.3.2 Trends in age-specific mortality rates of cerebrovascular disease (I60-I69): 1998-2006

Table 23 displayed the trends of mortality from cerebrovascular disease (stroke) is an rising trend, starting from the age of 35 onward with the death peaking in the age range 60-84 and decreasing in the age of 85 and above throughout 1998-2006 . The overall trends in age-specific mortality rates are increasing along with increasing age groups but mortality trends in 2006 are lower than in 2002 and 2004 almost all age group. Particularly, after age 60+ trends in age-specific mortality rates from stroke became double rates or more by increasing in higher age group. The highest death rate in every age group is found in males more than females (see also Figure 27).

In addition to examining age-adjusted standardization for stroke mortality inclined in Thailand between 1998 and 2004 from 10.21 to 39.03 per 100,000 men, from 6.9 to 27.42 per 100,000 women and from 8.56 per 100,000 people to 21.31 per 100,000 people in 2004 respectively. The general pattern was similar but in 2004-2006 the trends are dropped from 39.03 to 24.56 per 100,000 males, from 27.42 to 18.12 per 100,000 female, and from 33.18 to 21.31 per 100,000 people respectively. Mortality rates in males were found higher than females (see also Figure 28). The total percent changes of increased rates were around 40.55 percents per year during 1998-2004 (male 39.76 percents and female 51.20 percents per year), thereafter the total percent changes of decreased rates were around 12.15 percents per year during 2004-2006 (male 12.41 percents and female 11.76 percents per year).

Discussion

The present analyses of trends in stroke in Thailand from 1998-2004 confirm the substantial incline in certified mortality trends around 40.55 percents per year during 1998-2004 (male 39.76 percents and female 51.20 percents per year), thereafter it showed sharply decline trends during 2004-2006. The most common risk factor for all groups was hypertension and increase age, hypercholesterolaemia, cigarette smoking, diabetes mellitus, and obesity (Venketasubramanian, 1998) .

Hypertension is a known risk factor for stroke (Aekplakorn et al., 2008; Hasab, Jaffer, & Hallaj, 1999). Results from National Health Examination Survey (NHES) conducted in 1992, 1997, and 2004 show prevalence of hypertension (use the hypertension definition of average systolic blood pressure ≥140 mmHg and/or diastolic ≥90 mmHg, and self-reported use of antihypertensive medication during the past week) have been increasing. Likewise, one studied (Aekplakorn et al., 2008) showed the increasingly more serious problem of pre-hypertension and hypertension in Thailand (by using data from NHES III), with a rapidly rising and more uniform prevalence across regions, and with generally low levels of appropriate management. The prevalence of hypertension and pre-hypertension was higher in males compared to females (Aekplakorn et al., 2008). Those with pre-hypertension or hypertension were more likely to have concomitant cardiovascular risk factors than those with normal blood pressure and hypertension prevalence increased with age(Chuprapawan, 1991; Hasab et al., 1999; Hu, Chu, Wong, Lo, & Sheng, 1986; Porapakkham & Bunyaratpun, 2004). In addition previous study showed rising of these risk factors (except smoking) such as hypercholesterolemia, diabetes mellitus, obesity, stressful life events, socioeconomic factor have effected to increasing in stroke which (Aekplakorn et al., 2004; Aekplakorn et al., 2008; Aekplakorn, Klafter et al., 2007; The InterAsia Collaborative Group, 2002). This may explain the mortality trends have been increasing in 1998-2004. Males were higher than females. Interestingly, the trends were dropped from 39.03 to 24.56 per 100,000 males, from 27.42 to 18.12 per

100,000 female, and from 33.18 to 21.31 per 100,000 people respectively in 2006. It was not clear whether these trends were real. One possible for explanation stroke is linked with most risk factors known to affect atheroscerosis ; its preponderant association with hypertension has been established beyond reasonable doubt (Nicholls & Johansen, 1983). Several studies (Action on Smoking and Health Foundation, 1999; Aekplakorn, Abbott-Klafter et al., 2007; Aekplakorn et al., 2004; Aekplakorn et al., 2008; Chuprapawan, 1991; Knowledge and Research Center for Cigarett Control Center, 2007; Porapakkham & Bunyaratpun, 2004; Vathisathokit, 2004) in Thailand showed increasing trends of these risk factors. It was also well known that considerable risk reduction results from antihypertensive treatment (Hu et al., 1986). If so, mortality data underestimated its true burden. It may be due to has been attributed to the use of antihypertensive agents so that the mortality declined in 2006. Such the sustained mortality decline observed in the United States in the last few decades has been attributed to the use of antihypertensive agents (Hu et al., 1986). Consequently, this was chronic disability because stroke causes disability more often than death, stroke patients frequently require long hospital stays followed by ongoing support in the hospital, or nursing home care.

Increasing age is an important risk factor for stroke (Oxfordshire Community Stroke Project, 1983; Robins & Baum, 1981). The present finding showed trends in age-specific mortality rates from stroke after age 60+ years become double rates or more by increasing in higher age group. This may be due to some conditions beginning in middle age but progress severity as people age such as hypertension. Also mortality rates have increased with the highest rate in the age group of 70+ years (Jitapunkul, Kespichayawattana, Wivatvanit, & Kangkanpanich, 2003). The proportion of the elderly aged 60 year and above in Thailand has been steady rising from 7.36 percent in 1990 to 10.7 percent in 2007 (National Statistical Office, 1994, 2008). This reason agreed with the present finding that age and sex specific death rates from stroke have been more increasing among age 60-84 years for annual year during 1998-2006. This is seen among males and females.

However, it was possible in misclassification diagnosis—shifting from stroke to other cardiovascular diseases codes and the selection of a single underlying cause of death is frequently problematic in elderly people, who often have had several chronic diseases that concurrently led to death (Mathers, Fat, Inoue, Rao, & Lopez, 2005) could contribute to apparent changes in declined trend in 2006. In contrast to stroke, that in the same time frame showed a rise in mortality from IHD which we needed to further investigate in the future.

Strenght and limitations

This study based on vital statistics for giving only picture of trends in age-specific mortality rate. In using the results, users should keep in mind that (a) underestimation of mortality rates from cerebrovascular was inevitable if mortality data were used (b) systematical biases of mortality records existed during coding could be considered as incomplete death-reporting information (Ministry of Public Health, 1998, 2000).

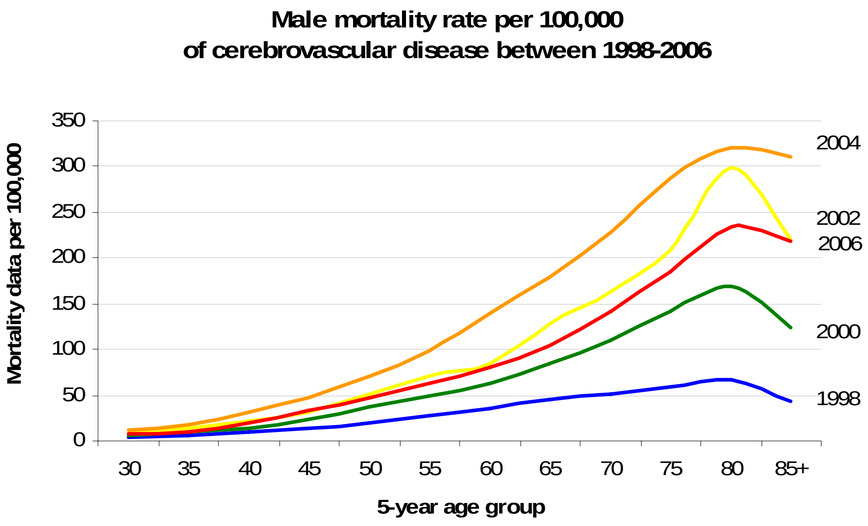
Conclusions

Thus, overall trends in age specific and standardized mortality rates showed increasing during 1998 to 2004 but sharply dropping in 2006. It was not clear whether these trends were real. Factors could be associated on stroke mortality—including antihypertensive treatment and improved survival following stroke—might account for part of the reduction in stroke mortality. However, we realized that there also may have been variation in diagnosis and medical care of stroke or in certification of stroke as a cause of death.

Table 23 Trends in age specific mortality rates from cerebrovascular disease: 1998-2006, Thailand (per 100,000)

Age Group	Males 1998	Males 2000	Males 2002	Males 2004	Males 2006	Females 1998	Females 2000	Females 2002	Females 2004	Females 2006	Both Sexes 1998	Both Sexes 2000	Both Sexes 2002	Both Sexes 2004	Both Sexes 2006
0-4	2.32	0.87	2.37	2.00	0.92	2.03	1.50	2.44	1.42	0.51	2.18	1.18	2.40	1.72	0.72
5-9	0.20	0.39	0.73	1.16	0.30	0.17	0.49	0.57	0.68	0.36	0.18	0.44	0.65	0.92	0.33
10-14	0.47	1.05	1.08	2.12	0.94	0.46	0.81	0.67	0.79	0.54	0.47	0.93	0.88	1.48	0.75
15-19	2.06	2.77	4.88	7.09	3.56	0.44	1.09	1.61	1.84	0.91	1.26	1.95	3.28	4.52	2.27
20-24	3.16	3.32	5.17	7.77	3.75	0.62	0.88	1.31	1.97	1.32	1.91	2.12	3.27	4.91	2.55
25-29	2.96	3.84	5.90	8.21	3.80	1.11	1.81	2.23	2.56	1.59	2.04	2.83	4.07	5.40	2.71
30-34	3.78	5.24	8.06	11.99	7.25	1.43	1.73	2.84	4.01	2.47	2.60	3.47	5.42	7.97	4.85
35-39	5.26	8.91	12.80	17.24	10.23	1.55	3.35	5.13	6.01	3.70	3.38	6.10	8.90	11.51	6.90
40-44	8.86	13.74	21.94	31.37	19.67	3.96	6.13	9.78	11.62	7.31	6.37	9.86	15.74	21.28	13.33
45-49	14.60	24.25	32.12	47.24	32.49	6.52	12.56	16.22	22.39	14.23	10.46	18.24	23.93	34.42	23.07
50-54	19.85	37.64	50.80	70.36	47.36	13.02	19.96	27.10	35.55	22.42	16.36	28.56	38.54	52.26	34.34
55-59	26.76	48.83	71.35	97.35	63.66	15.89	25.03	38.84	57.99	31.36	21.16	36.54	54.48	76.82	46.72
60-64	34.95	63.75	84.87	139.96	80.78	20.93	37.39	58.31	77.45	47.73	27.58	49.88	70.90	106.99	63.30
65-69	46.09	84.35	127.17	178.82	104.71	28.68	57.03	81.92	118.55	70.85	36.76	69.64	102.76	146.27	86.40
70-74	51.23	109.33	164.08	227.93	141.18	37.05	83.67	114.82	156.39	109.53	43.43	95.19	136.82	188.23	123.57
75-79	59.56	140.69	207.82	286.43	184.92	43.19	116.84	189.88	235.94	148.52	50.31	127.18	197.59	257.54	164.02
80-84	66.93	169.20	298.77	320.14	233.63	61.53	141.53	256.25	289.31	226.55	63.74	152.87	273.67	301.94	229.43
85+	42.73	123.72	219.32	310.89	218.43	46.06	130.53	267.07	315.38	252.71	44.75	127.86	248.35	313.64	239.50
Crude rate	**8.54**	**15.74**	**24.74**	**36.62**	**24.05**	**5.48**	**11.07**	**18.24**	**25.12**	**17.31**	**7.00**	**13.39**	**21.46**	**30.81**	**20.64**
Adjusted rate[a]	**10.29**	**18.80**	**27.75**	**38.93**	**24.44**	**7.66**	**14.96**	**22.85**	**29.93**	**19.37**	**9.12**	**17.18**	**25.70**	**35.01**	**22.25**

[a] Per 100,000 people by sex adjusted to standardization national population 2007



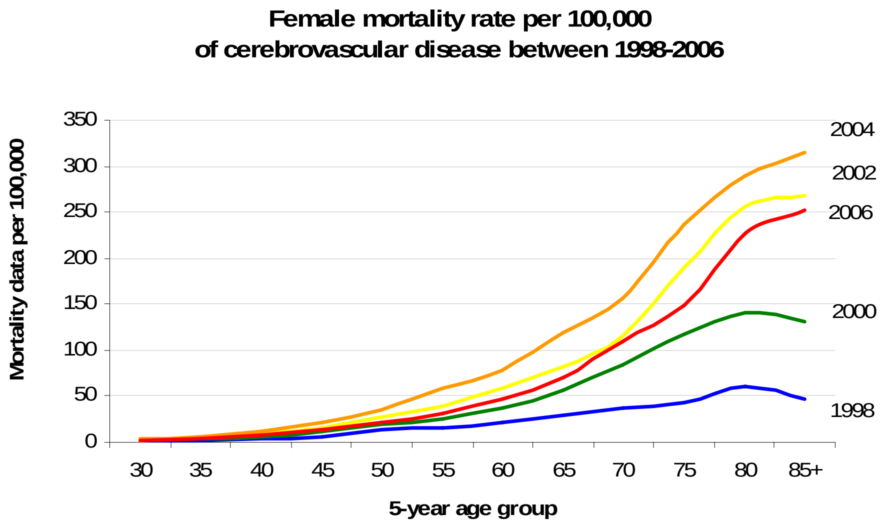


Figure 27 Trends in age specific mortality rate of cerebrovascular disease, 1998-2006

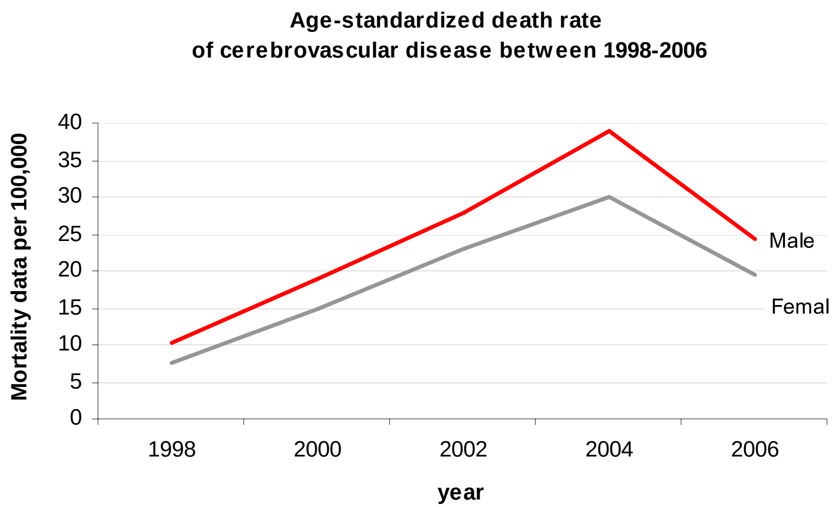


Figure 28 Mortality trends of cerebrovascular disease between 1998-2006

4.3.3 Trends in age-specific mortality rates from neoplasms (all forms) (C00-D48): 1998-2006

Table 24 displayed the trends of mortality from neoplasms (all forms) is an increasing one, starting from the age of 25 onwards with the death peaking in the age range 60-79 and decreasing in the age of 80 and above. Particularly, after age 45+ trends in age-specific mortality rates from neoplasms (all forms) became 2 or 3- folds by increasing in higher age group between 1998 and 2006.

Figure 29 showed the overall trends in age-specific mortality rates (both sex) for neoplasm (all forms) are increasing along with increasing age groups during this time. Although there was slightly difference rates of mortality trends between 2004 and 2006, the general trends were similarly.

Figure 30 showed mortality trends of age-adjusted standardization for neoplasm (all forms) for both sexes inclined over this time. The total percent changes of increased rates from neoplasms (all forms) were around 44 percent in 8 years (male 54 percents, female 49 percents).

Discussion

The present analyses of trends in neoplasms (all forms)— malignant neoplasm of lip, oral cavity and pharynx (C00-C14), malignant neoplasm of esophagus (C15), malignant neoplasm of stomach (C16), malignant neoplasm of colon, rectum and anus (C18-C21), malignant neoplasm of liver and intrahepatic bile ducts (C22), malignant neoplasm of pancreas (C25), malignant neoplasm of larynx (C32), malignant neoplasm of trachea, bronchus and lung (C33-C34), malignant neoplasm of skin (C43), malignant neoplasm of breast male (C50), malignant neoplasm of breast female (C50), malignant neoplasm of cervix uteri (C53), malignant neoplasm of other and unspecified part of uterus(C54-C55), malignant neoplasm of ovary (C56), malignant neoplasm of prostate (C61), malignant neoplasm of bladder (C67), malignant neoplasm of meninges, brain and other parts of central nervous system (C70-C72), non-hodgkin's lymphoma (C82-C85), multiple myeloma and malignant plasma cell neoplasms, leukemia(C91-C95), remainder of malignant neoplasms (C17, C23-C24, C26-C31, C37-C41, C44-C49, C51-C52, C57-C60, C62-C66, C68-C69, C73-C81, C88, C96-C97), and D00-D48)—in Thailand confirmed the substantial incline in certified mortality trends around 44 percent during from 1998 to 2006 (male 54 percents, female 49 percents).There were several possible for explanations. The most common risk factor for all groups was tobacco use, alcohol, dietary, physical activity patterns, overweigh, and obesity. These factors were associated rather than genetic factors play the major roles in the development of cancer. Cancer is also strongly associated with social and economic status ie highest in groups with the least education and patients in the lower socioeconomic classes have consistently poorer survival rates than those in higher strata (Puska et al., 2003).

Comparison between the present finding the evidence from National Health Examination Survey I, II, and III (in 1992, 1997, and 2004) found rising trends of total cholesterol, hypertension, alcohol consumption, diabetes mellitus, overweight, and obesity are increasing among age group (Chuprapawan, 1991; Porapakkham & Bunyaratpun, 2004; Thailand Health Research Institute, 1997). These health problems were remarkable among those who live in urban area (Jitapunkul, 1999). This is because living in urban residence was more likely to eat more western style food and less likely to perform physical activity that are also increases the risk of cancers mortality which has been associated with urbanization and modernization (Puska et al., 2003). For example, there was a marked increase in consumption of energy-rich food (such as fast food), a decrease in energy expenditure (through less physical activity and sedentary lifestyle), and loss of traditional social support mechanisms (Petcharoen et al., 2006).

However, the composition of the diet was also important since fruit and vegetables may have a protective effect by decreasing the risk for some cancer types such as oral, esophageal, gastric and colorectal cancer. And increased physical activity and appropriate lifestyle behaviors would also need to be improved to prevent the development of risk factors.

Strenght and limitations

This study based on vital statistics for giving only picture of trends in age-specific mortality rate. In using the results, users should keep in mind that (a) underestimation of mortality rates from cerebrovascular was inevitable if mortality data were used (b) systematical biases of mortality records existed during coding could be considered as incomplete death-reporting information (Ministry of Public Health, 1998, 2000).

Conclusion

The finding confirms the hypothesis that trends in age-specific mortality and age-standardized rates of chronic diseases (ischemic heart disease, cancers) among the population have been increasing (except cerebrovascular disease).

Table 24 Trends in age specific mortality rates from neoplasms (all forms): 1998-2006, Thailand (per 100,000)

Age Group	Males					Females					Both Sexes				
	1998	2000	2002	2004	2006	1998	2000	2002	2004	2006	1998	2000	2002	2004	2006
0-4	11.84	5.10	6.32	6.05	4.58	9.78	4.21	4.82	3.69	3.58	10.82	4.66	5.59	4.91	4.09
5-9	2.53	4.10	4.45	4.26	4.07	2.20	3.54	3.66	2.69	3.40	2.37	3.82	4.07	3.50	3.75
10-14	2.35	3.37	4.45	4.20	4.09	1.90	2.57	3.61	3.40	3.44	2.13	2.98	4.04	3.81	3.77
15-19	3.93	5.94	5.77	6.91	6.33	3.10	3.92	3.69	4.59	4.13	3.52	4.94	4.75	5.78	5.26
20-24	8.81	7.41	7.69	6.02	6.82	9.69	8.72	6.54	5.80	5.47	9.24	8.05	7.12	5.91	6.15
25-29	32.12	26.20	15.90	11.57	10.08	19.43	21.99	17.44	12.28	10.53	25.89	24.13	16.66	11.92	10.30
30-34	40.12	44.87	30.82	24.20	20.01	21.53	27.49	24.26	22.53	18.63	30.89	36.26	27.51	23.36	19.32
35-39	43.29	52.78	42.61	39.28	37.23	30.60	39.72	34.71	35.08	32.59	36.92	46.20	38.60	37.14	34.87
40-44	55.57	67.71	68.45	65.80	65.16	47.24	58.92	56.32	56.05	55.46	51.37	63.28	62.27	60.82	60.19
45-49	93.77	109.50	117.77	115.84	116.86	71.14	89.45	90.89	92.91	85.75	82.24	99.28	103.93	104.01	100.82
50-54	145.35	174.46	186.29	203.94	189.74	99.98	127.78	137.45	140.79	137.00	122.03	150.50	161.06	171.14	162.22
55-59	211.39	263.74	317.84	314.42	304.80	131.53	168.51	193.26	211.88	195.24	169.79	214.00	253.24	260.98	247.38
60-64	272.50	337.69	380.55	423.96	430.03	161.04	195.32	220.63	245.93	250.67	213.75	262.50	296.40	330.07	335.21
65-69	331.30	413.43	480.84	561.27	539.07	171.83	219.92	269.70	294.95	294.98	245.96	309.85	366.90	417.47	407.16
70-74	300.53	442.42	524.22	593.88	621.89	140.13	226.10	260.64	309.25	317.79	213.92	324.78	378.25	435.95	452.80
75-79	324.78	532.27	551.52	657.24	681.85	142.84	260.29	270.71	334.96	331.00	222.78	380.67	391.27	472.81	480.58
80-84	201.56	435.50	538.99	558.33	577.97	115.25	232.44	257.90	308.92	297.40	151.05	317.46	372.82	411.08	411.64
85+	105.98	260.52	305.04	374.72	437.52	63.29	161.96	192.99	228.27	239.68	80.29	201.55	236.84	284.99	316.00
Crude rate	**58.29**	**75.16**	**85.92**	**94.88**	**97.75**	**39.29**	**52.81**	**62.44**	**67.95**	**68.89**	**48.75**	**63.91**	**74.24**	**81.27**	**83.14**
Adjusted rate[a]	**69.44**	**87.30**	**93.69**	**99.11**	**97.82**	**52.36**	**69.12**	**74.34**	**80.13**	**77.94**	**62.12**	**79.78**	**85.75**	**91.43**	**89.66**

[a] Per 100,000 people by sex adjusted to standardization national population 2007

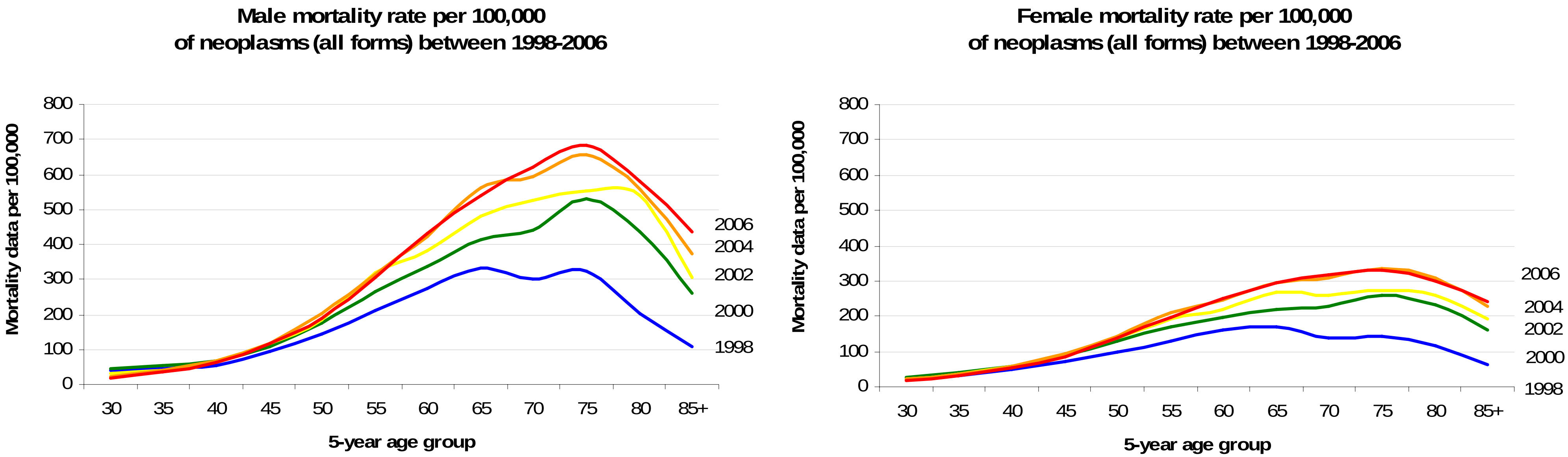


Figure 29 Trends in age specific mortality rates of neoplasm (all forms) between 1998-2006

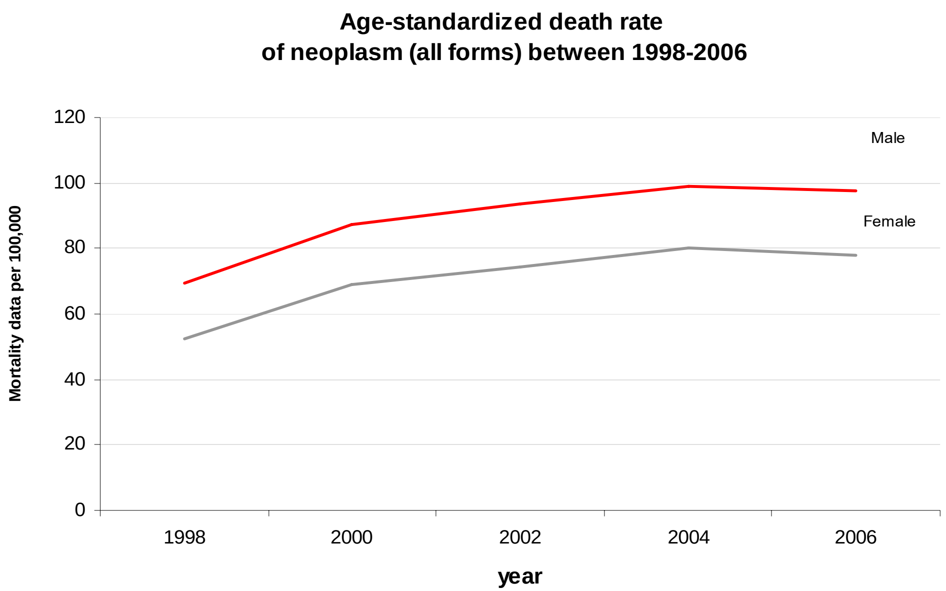


Figure 30 Mortality trends of neoplasms (all forms) between 1998-2006

4.4 Active life expectancy

This section presents trends of the proportion of active life expectancy to life expectancy at age 60 and over in Thailand, 2002 and 2007.

4.4.1 Trends of active life expectancy in the elderly in Thailand, 2002 and 2007

Table 25, Figure 31 and 32 displayed the total life expectancy (LE), active life expectancy (ALE), and the proportion of total life expectancy that is active (ALE/LE) among Thai population age 60 years and over. The life table results for the year 2002 and 2007 showed that elderly woman at all age had longer life expectancies than elderly men. Active life expectancy of women was also longer than that for men, although this excess decreased with age. The proportion of the remaining years spent without disability, estimated from the proportion of active life expectancy to the total life expectancy, was higher among men compared to women at all ages. The proportion of active life expectancy in both sexes also decreased with increasing age.

In 2007 for both males and females the LE at 60 was 16.14 and 19.47 year of which 0.57 and 1.03 years respectively would be disability.

Table 25 Life expectancy, active life expectancy and proportion of active life expectancy (ALE/LE), by age and sex, 2002 and 2007

	2002				2007			
	LE	ALE	ALE/LE	DLE	LE	ALE	ALE/LE	DLE
Male								
60-64	15.70	15.26	97.19	0.44	16.14	15.57	96.44	0.57
65-69	12.50	12.06	96.49	0.44	12.85	12.28	95.60	0.57
70-74	9.68	9.23	95.39	0.45	9.94	9.41	94.63	0.53
75-79	7.28	6.83	93.76	0.45	7.48	6.97	93.14	0.51
80+	5.32	4.82	90.67	0.50	5.48	4.88	89.13	0.60
Female								
60-64	19.10	18.31	95.87	0.79	19.47	18.44	94.70	1.03
65-69	15.22	14.45	94.94	0.77	15.52	14.49	93.34	1.03
70-74	11.73	10.94	93.26	0.79	11.97	10.94	91.38	1.03
75-79	8.77	7.96	90.80	0.81	8.94	7.90	88.37	1.04
80+	6.40	5.51	86.12	0.89	6.52	5.38	82.53	1.14

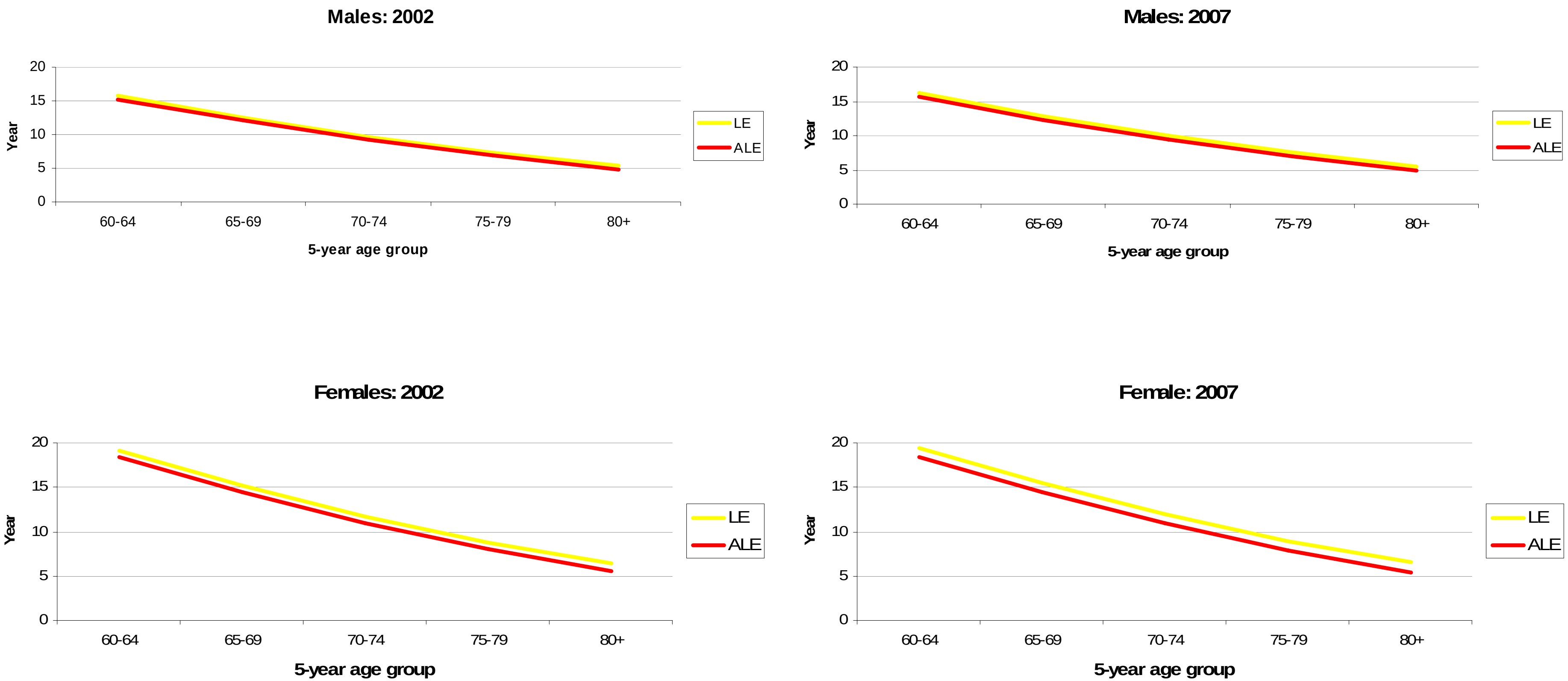


Figure 31 Life expectancy and active life expectancy by age and sex, 2002 and 2007

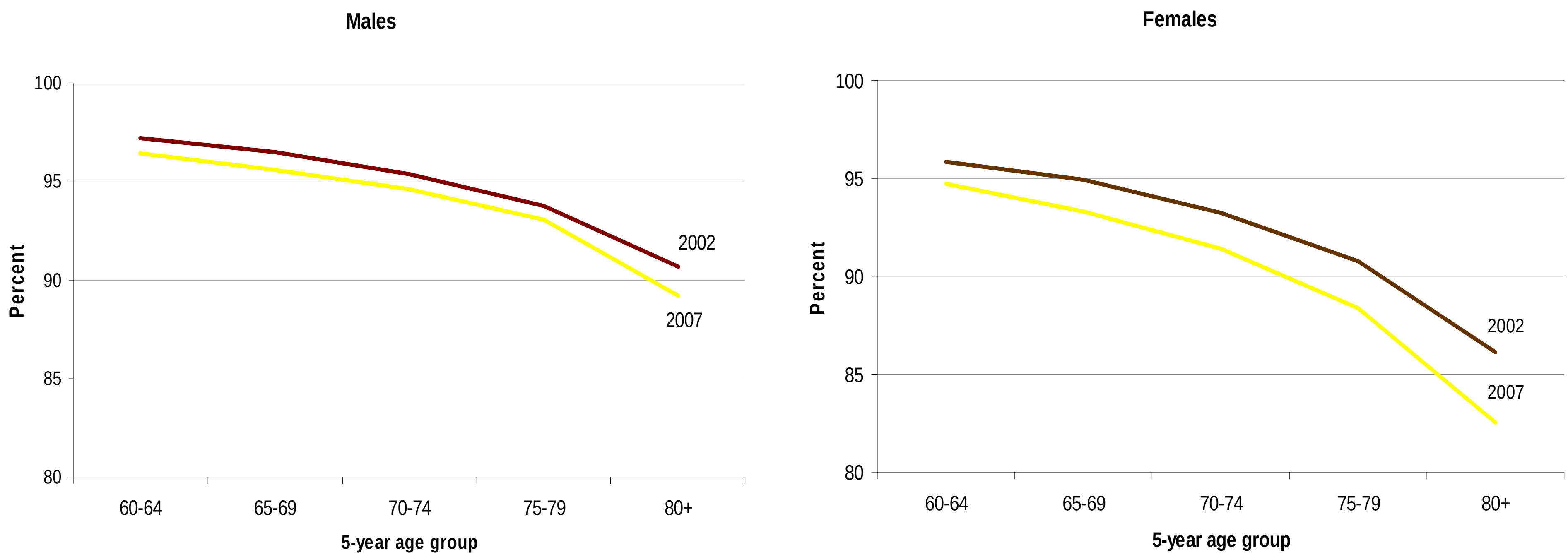


Figure 32 proportion of active life expectancy (ALE/ LE) by age and sex, 2002-2007

Discussion

The researcher attempted to find further empirical evidence concerning the question of whether an increase in life expectancy results in a prolonged period of disability or in an increase in the number of years that are lived in good health. Active life expectancy, the remaining number of years at a particular age that an individual lives without dependency in activities of daily living, is a comprehensive indicator that summarizes the mortality and disability experience of all population.

As expected, ALE in both sexes and in all countries decreased with advancing age but remained substantially high; ALE was also lower among women than among men, which reflects the superior longevity of women and the higher mortality of men at all ages. Among men a clear in the percentage of life expectancy free of disability was observed. Women almost universally live longer than men but spend a greater number of absolute years and a greater proportion of their life with disability and ill-health.

The study concludes that the health status over the past 5 years supports the view that elderly people may not only live longer, but also live longer in bad health. These results tend to confirm the theory of "expansion of morbidity" proposed by Gruenberg (Gruenberg, 1977), suggesting that improvements in mortality have occurred because of the improvements in mortality in recent years have occurred by increasing the duration of time that a person survives with a disease or disability (Unger, 2006).

In sum, the pattern of change in Thai population health status from 2002 to 2007 is one of increasing life expectancy accompanied by expansion of morbidity. In 2007, 1.03 of the 19.47 years of life gained by females was spent in disability, whereas 0.57 of the 16.14 years gain by males were spent in disability.

Strenght ans limitations

Some limitations should consider. This study was not taking into consideration reversible health state. Also, the international comparison of active life expectancy will depend on the way disability is measured. Since there is no agreement on the definition and measurement of disability, the definition of disability in this study was the restriction in ADL, which included only four activities, ignoring other dimensions of functional limitations. Depite these limitations, active life expectancy measure have two major advantages: (a) active life expectancy is relatively easy to measure and monitor, and they do integrate non-fatal outcomes into a single index or summary measure, (b) the monitoring of active life expectancy is a tool in developing public health policy of nation much intension was paid to internationally comparity.

Conclusions

The finding confirms the hypothesis that trends of the proportion of active life expectancy to life expectancy at age 60 is decreasing.

CHAPTER V

SUMMARY AND RECOMMENDATION

This chapter consisted of three sections. The first section contained the summary of all chapters in this study. The final two sections provided a discussion of the recommendations for further research and for policy formulation.

5.1 Summary

Life Expectancy continues to increase in Thailand as a result of declining infant and age-specific mortality. The process of population aging of Thailand is changing more rapidly than that in the West an effect of urban environment such as a change in life style or an increase in the prevalence of chronic diseases. Possibly, morbidity-disability may be on the rise in Thailand and it will affect the estimated problems and need of Thai population in the future.

The question is (a) Is morbidity and disability of the population expanding? (b) Does living longer mean living healthier? This bring about four hypotheses as follow: (a) Trends of the chronic diseases (HT, DM)) and health parameters (FBS, TC, and BMI) by aged-specific prevalence rates among the population has been increasing, (b) trends of the ADL disabilities by aged specific rates among the population has been increasing, (c) trends in age-specific mortality rates of chronic diseases (ischemic heart disease, cerebrovascular disease, and cancers) among the population have been increasing, (d) trends of the proportion of active life expectancy to life expectancy at age 60 is decreasing.

The study is undertaken in order to: (a) document trends of the chronic diseases (hypertension, diabetes) and health parameters (FPG, TC, BMI) by aged-specific prevalence rates among the population has been increasing, (b) investigated trends of the ADL disabilities by aged specific rates among the population has been increasing, (c) study trends in age-specific mortality rates of chronic diseases (ischemic heart disease, cerebrovascular disease, and cancers) among the population have been increasing, (d) examine trends of the proportion of active life expectancy to life expectancy at age 60 is decreasing.

In this study there are three data sources—morbidity data, disability data, and mortality data. Firstly, the data source for studying trends of age-specific prevalence rates of chronic diseases ((DM, HT) and health parameters (FPG, TC, and BMI) derived from NHES I (1991-1992) and NHES III (2003-2004). This survey was conducted by Ministry of Public Health, Health Systems Research Institute, and National Health Foundation. Secondly, the data source for studying trends of age-specific prevalence rates of ADL disabilities derived from SET 2002 and 2007. This survey conducted by National Statistical Office. Thirdly, the data sources for studying trends in age-specific mortality rates of the chronic diseases (ischemic heart disease, cerebrovascular disease, and cancers) was obtained in vital statistics reports which were arranged in causes of death during 1998-2006. The Ministry of Public Health has cooperated with the Ministry of Interior and reached agreement on using the civil registration database of the local Administration Department, Ministry of Interior for Vital Statistics on birth and death analysis. All deaths have been required by law to be register since 1916. Statistics on Caused of Death in 1996 was analyze from the Civil registration database of Bureau of Registration, Ministry of Interior, after the coding for underlying cause of death was done under ICD-10 basis. Finally, data for studying trends of the proportion of ALE to life expectancy at age ≥ 60 years are derived from SET (2002 and 2007); the researcher calculated by Sullivan Method with combine death data and ADL disability rate.

The study used the Statistical Program to analyze the data. The descriptive statistics such as frequency and mean used to describe prevalence of chronic diseases (DM, HT) and health parameters (FPG, TC, BMI). Also, the descriptive statistics such as frequency used to describe prevalence of ADL disabilities was calculated by frequency counting non-disabled, IADLs disabled, and ADLs disabled. The prevalence of ADL disabilities in each state was estimated for each sex and age groups. An individual's functional status was assessed in terms of activity restriction activities of daily living (ADLs). The results covered four dimensions as follows (see also Table 26):

Table 26 Trends in morbidity, disability, mortality, life expectancy, and active life expectanct in Thailand

Morbidity	Hypertension	↑	NS
	Diabetes	↑	Sig
	Hypercholesterolemia	↑	Sig
	Overweight	↑	Sig
	Obesity	↑	Sig
	Total cholesterol	↑	Sig
	Fasting plasma glucose	↑	Sig
	Body mass index	↑	Sig
Disability	Eating, dressing, bathing and toilet	↑	-
Mortality	Ischemic heart diseases	↑	-
	Cerebrovascular disease	↑	-
	Cancers	↑	-
Active Life Expectancy		↑	-

↑ = increase, significant (P-value < 0.05), NS=nonsignificant

The first dimension was trends in age-specific prevalence rate of chronic diseases and health parameters. It was found trends in age-specific prevalence rate of chronic diseases and health parameters tend to increase.

The second dimension was trends in age-specific prevalence rate of ADL disabilities. This dimension focused on disabilities, which was largely the consequences of medical condition. Disability in this study refered to the one or more restrictions on the activities of daily living (ADLs): eating, dressing, bathing and toileting. It was found that the overall prevalence of disability among the elderly tend to increase 2% between 2002 and 2007. The restriction in bathing/ toileting was highest among all of the activities. The findings indicated that elderly women had a higher prevalence of unhealthy states in each dimension increase with age. For regional differentials, the prevalence of ADL disabilities was the same results found at the national level. It was found that the elderly in the Northeast had the highest prevalence of disability, while the elderly in the south had the lowest prevalence of disability.

The third dimension discusses trends in age-specific mortality rates of chronic diseases (ischemic heart disease, cerebrovascular disease, and cancers) among the population have been increasing.

Finally, ADL disability identifies basic independence in daily personal care, and it is often used as the benchmark of the burden of the disease in an elderly population. Thus, among the three dimensions of health status mentioned above, ADL disability was chosen as the metric to estimate active life expectancy. ALE is an index of population health that combines mortality and disability. The findings showed that in the year 2007 the ALE at age 60 was years for men and years for women. Although women live longer than men, their proportion of the remaining years lived without disability, which measure by the proportion of ALE to the total life expectancy, was lower than that of men. The proportion of active life expectancies in both sexes also declined with age. The study concludes that the health status over the past 5 years supports the view that elderly people may not only live longer, but also live longer in bad health. These results tend to confirm the theory of “expansion of morbidity”.

5.2 Recommendations for policy formulation

a) Policies for promoting public health change involve organizational statements or general rules design to facilitate healthy lifestyle choices. In other words, health promotion policies are an attempt to produce healthy behaviors that are likely to be sustained. Most states are in the initial stages of developing and implementing policies that support environmental changes related to nutrition and physical activity. For example, environmental changes primarily focus on improving access to physical activity opportunities and healthy foods through new walking trails, community gardens. Tax revenues generate from the sale of foods high in saturated fats could be used to subsidize the cost of healthful foods or health promotion programs.

b) Encourage the scientific community to join in the efforts to create more responsible solutions for overweight, obesity, and hypercholesterolemia epidemic at the societal level.

c) Overweight and obesity among children have increased. Health policy makers should promote healthy behaviours in childhood because it can not only reduce the likelihood that children develop cardiovascular disease later in life, but also set the pattern of healthy behaviour they carry into adulthood. For example implementation of rewards and other incentives for consumption of healthful foods in school settings may introduce students to healthy eating, thereby encouraging healthy eating habits at an early age.

d) Building the community capacity through education and support for organized activity will lead to the planning and implementation of effective preventive interventions. Advocacy for regulations and laws that promote health are need.

e) Monitoring of the situation through regular National Health Examination Surveys are necessary by a dramatic scale up of screening treatment and control. It may also be worthwhile extending opportunistic screening to those less than 40 years of age for low rates of awareness in the younger age groups. As such, increasing the proportion of hypertension and diabetes that is diagnosed, perhaps through opportunistic screening of high-risk individuals, might be an appropriate and relatively low cost means of addressing the growing hypertension and diabetes-related disease burden in Thailand.

f) The life course perspective could be a useful approach in promoting a healthier life-style in early stages in order to have an impact in later life. In the meantime, measures to prevent or delay the onset of chronic diseases and disability among older people in Thailand are urgently needed. Preparation for old age including a good practice in health and life style should be encouraged in all society. In spite of the growing awareness of ageing issues, preoccupation with more immediate economic problems has been a major reason that has kept planners and policy-maker from formulating appropriate policies and establishing the required infrastructure, particularly with respect to the most vulnerable sub-group of elderly person, i.e. women.

g) These findings have important implications for health and long-term care programs. Most of the senior can not avoid an unpleasant period of dependence. Therefore, communities must provide appropriate and acceptable services of them:

(a) Medical resources must be properly allocated according to the health priorities.

(b) Primary health care, community service and geriatric health services are key approaches to enable elderly women and men to have access to preventive and curative services. Including, they should prepare that changes in the availability of caregivers. This may have use of paid services among disabled community residents, including those with informal caregivers that support the possibility that average costs for the disabled rose.

(c) Family-life education is an important vehicle for strengthening inter-generational ties to foster positive attitudes towards elderly persons. Additional, persons who had higher educational attainment were more likely to have less disability. (see Appendix A) The exact mechanism of educational attainment still remain unknown, education was believed to be correlated with flexibility and adaptability which were necessary to the change imposed by a potentially disabling condition. Furthermore, education might influence on person’s ability to acquire knowledge on disease prevention. Therefore, policies that impose on supporting and providing education to the people might be benefit not only to the health status of present population, but would have indirect effect on the future quality of life of this population.

(d) All health and social cares must aim at making senior citizens realize and demand optimal independence, autonomy and social contribution as long as possible i.e. successful ageing.

h) The present findings show prevalence of bathing and toilet disability are most problematic. The policy could be the adaptation of environment to enable persons who had limitations to be able to participate in the society. Barrier-free environment should be the designate goal of government. For example toilet designed for persons with disability.

i) Monitoring of disability trends through the national survey programs, with addition of more quantitative disability measures to the instruments and inclusion of quality-of-life measures.

j) The national surveys relate to health status of the elderly that conducted regularly by the government should cover all aspects of health status, such as chronic diseases, self-perceive health, function limitations, disability (ADLs/ IADLs) and cause of disability. The data from these surveys will be the major database on health status of the elderly in Thailand. This database will be useful for the researcher in this field and for cross-national comparison as well.

k) Ideally, longitudinal data should be used as this permits transitional probabilities of moving between disabled states to be included in calculations of DFLE. However, establishing large scale, national representative longitudinal studies is more difficult and is more costly. National prevalence surveys, if repeat at interval, provide a means of monitoring the impact of health and social policies by providing information on trends in DFLE for policy makers. To reduce the incidence and prevalence of disability in Thailand, as well as the personal, social, and economic consequences of disability in order to improve the quality of life.

5.3 Recommend for further research

a) The future research on the related issues such as smoking, alcohol, sugar consumption, economic costs that relate to chronic diseases or factors that relate to expansion of morbidity should be taken. The knowlwdge about these issues is important for policy formulation.

b). The issue of shifting from stroke to other cardiovascular diseases codes and the selection of a single underlying cause of death is frequently problematic in elderly people, who often have had several chronic diseases that concurrently led to death could contribute to apparent changes in declined trend in 2006. In contrast to stroke, that in the same time frame showed a rise in mortality from IHD which we need to further investigate in the future.

c) The definition of disability should be clarified and discussion regarding this topic among those who interested in the health of the elderly. The discussion on definition should be the top priority in order to find consensus with standard definition and the comparison across surveys will be meaningful and the monitoring process can be set.

d) The severity level of disability as well as the duration of having disability should be considered in the research on disability. The severity of disability is important for more precisely specifying disability and for defining the threshold for classifying a person as disabled. The duration of disability indicates the transient or chronic disability.

e) The present finding shows that the number of disabled elderly would increase rapidly in the future owning to population ageing. The future research on the related issues such as the economic costs of disability, the family and community care of disabled elderly and the rehabilitation of disabled persons should be taken. The knowledge about the issues is important for policy formulation.

f) The study of the differences in active life expectancy between subgroups of population such as socioeconomic groups and minority groups are recommended. This aspect is important for developing the program to reduce the health inequities in Thailand.

REFERENCES

Action on Smoking and Health Foundation. (1999). Survey of Smoking Behavior among Thai Population in 1999. Retrieved 23 july, 2007, from http://www.ashthailand.or.th/th/informationcenter.php?act=list&categoryID=2&p=2

Aekplakorn, W., Abbott-Klafter, J., Premgamone, A., Dhanamun, B., Chaikittiporn, C., Chongsuvivatwong, V., et al. (2007). Prevalence and Management of Diabetes and Associated Risk Factors by Regions of Thailand: Third National Health Examination Survey 2004. *Diabetes Care 30*(8): 2007-2012.

Aekplakorn, W., Chaiyapong, Y., Neal, B., Chariyalertsak, S., Kunanusont, C., Phoolcharoen, W., et al. (2004). Prevalence and Determinants of Overweight and Obesity in Thai Adults: Results of the Second National Health Examination Survey. *Journal Medicine Association Thailand 87*(6): 685-693.

Aekplakorn, W., Klafter, J. A., Khonputsa, P., Tatsanavivat, P., Chongsuvivatwong, V., Chariyalertsak, S., et al. (2008). Prevalence and management of prehypertension and hypertension by geographic regions of Thailand: the Third National Health Examination Survey, 2004 *Journal of hypertension 26*: 191-198.

Aekplakorn, W., Klafter, J. A., Premgamone, A., Dhanamun, B., Chaikittiporn, C., Chongsuvivatwong, V., et al. (2007). Prevalence and Management of Diabetes and Associated Risk Factors by Regions of Thailand: Third National Health Examination Survey 2004. *Diabetes care 30*(8): 2007-2012.

Cheepudomwit, S., et al. (2003). The Prevalence and Management of Diabetes in Thai Adults: The International Collaborative Study of Cardiovascular Disease in Asia 26: 2758-2763.

Alter, G., & Riley, J. C. (1989). Frailty, sickness and death: models of morbidity and mortality in historical populations. *Population Studies* (43).

Amos, A. F., McCarty, D. J., & Zimmet, P. (1997). The rising global burden of diabetes and its complications: estimates and projections to the year 2010. . *Diabetic Medicine 14*: S7-85.

Arnett, D. K., Jacobs, D. R., Jr., Luepker, R. V., Blackburn, H., Armstrong, C., & Claas, S. A. (2005). Twenty-Year Trends in Serum Cholesterol, Hypercholesterolemia, and Cholesterol Medication Use: The Minnesota Heart Survey, 1980-1982 to 2000-2002. *Circulation 112*(25): 3884-3891.

Baltali, M., Gokcel, A., Kiziltan, H. T., Korkmaz, M. E., Topcu, S., Yalcin, F., et al. (2003). Association between the metabolic syndrome and newly diagnosed coronary artery disease. *Diabetes Nutr Metab 16*: 169–175.

Bebbington, A. (1988). The expectation of life without disability in England and Wales. *Social Science & Medicine 27*(4): 321-326.

Bebbington, A. C. (1991). The expectation of life without disability England and Wales: 1976-88. *Population Trends 66*: 26-29.

Chayovan, N. (2002). Thai elder population. In S. Jitapunkul, N. Chayowan & S. Yodpeth (Eds.), *Thai elderly population:knowledge, situation, suggestion of the research and policy* (pp. (2-1)-(2-42)). Bangkok: Chulalongkorn University.

Chooprapawan, J. (1996). *Survey of the Welfare of the elderly in Thailand, 1995*: Ministry of Public Health; WHO; The regents of the University of Michigan; Institute of Population Studies, Chulalongkorn University.

Chuprapawan, J. (1991). *Report of National Health Examination Examination Survey I, 1991-1992*. Bankok: Thailand Health Research Institute.

Chuprapawan, J., Porapakkham, Y., & et al. (2000). *Report on cause of death in Thailand: Phase I*. Bangkok,: Thailand Research Fund.

Crimmins, E. M., Hayward, M., & Saito, Y. (1994). Changing mortalty and morbidity rates and the health status and life expectancy of the older population. *Demography 31*: 159-175.

Crimmins, E. M., & Hayward, M. D. (1997). "What can we learn about competence at the older ages from active life expectancy" In W. Schaie, S. Willis & M. Hayward (Eds.), *Social Structural Mechanisms for Monitoring Competence in Old Age*. New York: Spinger.

Crimmins, E. M., Saito, Y., & Hayward, M. D. (1993). "Sullivan and multistage methods of estimating active life expectancy:Two methods, two answers". In J. M. Robine, C. D. Mathers, M. R. Bone & I. Romieu (Eds.), *Calcultsation of Health Expectancies:Harmonization, Consensus Achieved and Future Prospec*. Paris: John Libby Eurotext.

Cutler, D. M. (2001). Declining disability among the elderly. *Health Aff, 20*, 11-27.

Daviglus, M. L. (2005). Health Care Costs In Old Age Are Related To Overweight And Obesity Earlier In Life. *Health Aff*, hlthaff.w5.r97.

Doblhammer, G., & Kytir, J. (2001). Compression or expansion of morbidity? Trends in healthy-life expectancy in the elderly Austrian population between 1978 and 1998. *Social Science & Medicine 52*(3): 385-391.

Dockery, D. W., Pope, C. A., Xu, X., & et al. (1991). An association with air pollution and mortality in six U.S. cities. *New England Journal Medicine 329*: 1753-1759.

EHEMU Country Reports. (2005). *Health expectancy in Luxemberg*: European health expectancy monitoring.

Engel, G. L. (1977). The need for a new medical model: a challenge for biomedicine. *Science 196*(4286): 129-136.

Fanshel, S., & Bush, J. W. (1970). A health-status index and its application to health-services outcomes. *Operational Research* 1021-1066.

Feldman, J. (1983). Work ability of the aged under conditions of improving mortality. *Milbank Q/Health Society 61*: 430-444.

Freedman, V. A., Martin, L. G., & Schoeni, R. F. (2002). Recent trends in disability and functioning among older adults in the United Strates: a systematic review. *JAMA 288*: 3137-3146.

Freedman, V. A., Martin, L. G., Schoeni, R. F., & Cornman, J. C. (2008). Declines in late-life disability: The role of early- and mid-life factors. *Social Science & Medicine 66*(7): 1588-1602.

Fries, J. F. (1980). Aging, natural death, and the compression of morbidity. *New England Jounal of Medicine 303*: 130-135.

Fries, J. F. (1983). The compression of morbidity. *Milbank Memorial Fund Quaterly/Health and Society 61*: 397-419.

Fries, J. F. (1988). Aging, illness and health policy: implications of the compression of morbidity. *Prespect Biol Med 31*: 407-428.

Fries, J. F. (1989). 'The compression of morbidity: near or far?' *Milbank Quarterly 67*: 208-232.

Fries, J. F. (1993). 'Compression of morbidity: lifespan, disability, and health care costs'. *Facts and research in gerontology 7*: 183-190.

Grotto, I., Grossman, E., Huerta, M., & Sharabi, Y. (2006). Prevalence of prehypertension and associated cardiovascular risk profiles among young Israeli adults. *Hypertension 48*: 254-259.

Gruenberg, E. M. (1977). The failure of success. *Milbank Memorial Fund Quarterly/ Health and Society 55*: 33-24.

Hasab, A. A., Jaffer, A., & Hallaj, Z. (1999). Blood Pressure patterns among the Omani population. *Eastern Mediterranean Health Journal 5*(1): 46-54.

Health Research System Institute & Institute for Population and Social Research. (2003). Population projection for Thailand, 2000-2025. In (Amarin printing and publishing ed., pp. 7-13). Bangkok: Mahidol University.

Hoem, J. M. (1970). Point estimation of forces of transition in demographic model. *Jounal of the Royal Statistical Society B 33*: 275-289.

Hoem, J. M. (1977). A markov chain model of working life table. *Scandinavian Actuarial Journal*: 1-20.

Howse, K. (May 2006). *Increase life expectancy and the compression of morbidity: A critical review of the debate, Working paper No.26*: Oxford Institute of Aging Working Papers.

Hu, H.-H., Chu, F.-L., Wong, W.-J., Lo, Y.-K., & Sheng, W.-Y. (1986). Trends in mortality from cerebrovascular disease in Taiwan. *Stroke 17*(6): 1121-1124.

Hubert, H. B., Bloch, D. A., Oehlert, J. W., & Fries, J. F. (2002). Lifestyle habbit and compression of morbidity. *Gerontologist 57A*: M347-351.

Human Resources Planning Division. (1995). Population Projections for Thailand 1990-2020. In. Bangkok: Human Resources Planning Division, National Economic and Social Development Board.

Jagger, C. (1999). Health Expectancy Calculation by the Sullivan method: A practical guide. *NUPRI research paper series No.68*.

Jitapunkul, S. (1999). *Elderly women in Thailand: a current status*: Chulalongkorn University.

Jitapunkul, S. (2000). Expansion of chronic diseases and disability among Thai population: hypotheses from elderly research. *Journal of Thai gerontology, January-March 1*(1): 42-50.

Jitapunkul, S., & Bunnag, S. (1997). *Aging in Thailand:1997* (Thai society and geriatric medicine ed.). Bangkok, Thailand.

Jitapunkul, S., Chayowan, N., Yodpeth, S., & et al. (2002). Health and Ageing. In S. Jitapunkul, N. Chayowan & S. Yodpeth (Eds.), *Thai elderly population:knowledge, situation, suggestion of the research and policy* (pp. (4-1)-(4-40)). Bangkok: Chulalongkorn University.

Jitapunkul, S., Kespichayawattana, J., Wivatvanit, S., & Kangkanpanich, P. (2003). *Developing intregrated response of health care systems to rapid population aging (INTRA)*. Bangkok.

Jitapunkul, S., Kunanusont, C., Phoolcharoen, W., Suriyawongpaisal, P., & Ebrahm, S. (2003). Disability-free life expectancy of elderly people in a population undergoing demographic and epidemiologic transition. *Age and Aging 32*: 401-405.

Jordan, C. W. (1952). *Society of Actuarie's textbook on life contingencies*. Chicago.

Kannel, W. B., & McGee, D. L. (1979). Diabetes and cardiovascular disease The Framingham study. *J Am Med Assoc 241*: 2035-2038.

Katz, S. (1983). Assessing self-maintenance: Active of daily living, mobility, and instrumental activities of daily living. *Journal of the American Geriatrics Society 31*(12): 21-26.

Katz, S., Branch, L. G., & Papsidero, J. A. (1983). Active Life Expectancy. *New England Journal Medicine 309*: 1218-1224.

Katz, S., Ford, A. M., Moskowitz, R. M., Jackson, B. A., & Jaffer, M. W. (1963). Studies of illness in the aged. The index of ADLs: A standardized measure of biological and psycho-social function. *JAMA 185*: 914-919.

Khumya, T., & Jitapunkul, S. (2000). Live longer with more work?: work life expectancy 1985-1995. *Journal of Thai gerontology, January-March 1*(1): 1-4.

Knowledge and Research Center for Cigarett Control Center. (2007). *Survey of Smoking Behavior among Thai population age 15+ year, 2000-2006* Mahidol University.

Kosulwat, V. (2002). The nutrition and health transition in Thailand. *Public Health Nutrition 5*(1A): 183-189.

Kramer, M. (1980). The rising pandemic of mental disorder and associated chronic diseases and disabilities. *Acta Psychiatr Scand 62*((suppl 285)): 282-297.

Krousel-Wood, M., Thomas, S., Muntner, P., & Morisky, D. (2004). Medication adherence: a key factor in achieving blood pressure control and good clinical outcomes in hypertensive patients. *Curr Opin Cardiol 19*: 357-362.

Kuulasmaa, K., Tunstall-Pedooe, H., Dobson, A., & et al. (2000). Estimation of contribution of changes in classic risk factors to trends in coronary-event rates across the WHO MONICA project populations. *Lancet 355*: 675-687.

Laditka, S., & Hayward, M. D. (2003). The Evolution of demographic methods to calculate health expectancies. In Robine. J.M, Jagger. C, Mathers.C.D, Crimmins. E.M & Suzman.R.M (Eds.), *Determining health expectancies* (pp. 221-234). England: John Wiley & Sons.

Laditka, S. B., & Wolf, D. A. (1998). New methods for analysing active life expectancy. *Journal of Aging Health 10*: 214-241.

Land, K. C., Guralnik, J. M., & Blazer, D. G. (1994). Estimating increment-decrement life tables with multiple covariates from panel data: the case of active life expectancy. *Demography 31*(12): 297-319.

Manton, K. G. (1982). Changing concepts of morbidity and mortality in the elderly population. *Milbank Memorial FundQuarterly/ Health and Society 60*: 183-244.

Manton, K. G., & Stallard, E. (1991). Cross-sectional estimates of active life expectancy for the U.S. elderly and oldest-old populaion. *J. Gerontol 46*: S170-182.

Manton, K. G., & Stallard, E. (1996). Changes in health,mortality and morbidity and their impact on long-term care needs. *Journal of Aging & Social Policy 7*: 25-52.

Manton, K. G., Stallard, E., & Corder, L. S. (1995). Changes in morbidity and chronic disability in the US elderly population: Evidence from the 1982, 1984, and 1989 National Long Term Care Surveys. *The Journal of Gerontology 50B*: S194-S204.

Marroquin, O. C., Kip, K. E., Kelley, D. E., Johnson, B. D., Shaw, L. J., Bairey Merz, C. N., et al. (2004). Metabolic syndrome modifies the cardiovascular risk associated with angiographic coronary artery disease in women: a report from the women's Ischemia Syndrome Evaluation *Circulation 109*: 714–721.

Mathers, C. D., Bernard, C., Iburg, K. M., Inoue, M., Fat, D. M., Shibuya, K., et al. (2003). *Global Burden of Disease in 2002: data sources, methods and results.* Paper presented at the Global Programme on Evidence for Health Policy Discussion Paper No. 54 World Health Organization (revised February 2004).

Mathers, C. D., Fat, D. M., Inoue, M., Rao, C., & Lopez, A. (2005). Counting the dead and what they died from: an assessment of the global status of cause of death data. *Bulletiin World Health Organization 83*(3): 171-177c.

Minaire, P. (1992). Model of disability *Bulletin World Health Organization 70*(3): 373-379.

Ministry of Public Health. (1994). *Public Health Statistics A.D. 1993*. Bangkok.

Ministry of Public Health. (1998). *Public health statistics A.D. 1998*. Nonthaburi.

Ministry of Public Health. (1999). *Public Health Statistics A.D. 1998*. Nonthaburi.

Ministry of Public Health. (2000). *Public Health Statistics A.D. 2000*. Nonthaburi.

Ministry of Public Health. (2001). *Public Health Statistics A.D. 2000*. Nonthaburi.

Ministry of Public Health. (2002). *Public Health Statistics A.D. 2001*. Nonthaburi.

Ministry of Public Health. (2003). *Public Health Statistics A.D. 2003*. Nonthabiri.

Ministry of Public Health. (2004). *Public Health Statistic A.D. 2003*. Nonthaburi.

Ministry of Public Health. (2005a). Major Public Health Programmes and Activities Implemented in Thailand. In S. Wibulpolprasert (Ed.), *Thailand Health Profile 2002-2004*. Nonthaburi.

Ministry of Public Health. (2005b). Nutrition news "Results in nutrition of Thai people should modify". information center Retrieved April 28th, 2005, from http:nutrition.anamai.moph.go.th

Ministry of Public Health. (2005c). *Public Health Statistics A.D 2004*. Nonthaburi.

Ministry of Public Health. (2005d). Situations and Trends of Health Determinants. In S. Wibulpolprasert (Ed.), *Thailand Health Profile 2001 - 2004*. Nonthaburi.

Ministry of Public Health. (2006). *Public health statistics A.D 2005*. Nonthaburi.

Ministry of Public Health. (2007a). *Mid-year population 2004-2006*. Nonthaburi: Ministry of Public Health.

Ministry of Public Health. (2007b). *Public health statistics A.D 2006*. Nonthaburi.

Morris, R. W., Whincup, P. H., Lampe, F. C., & et al. (2001). Geographic variation in incidence of coronary heart disease in Britain: the contribution of established risk factors. *Heart 86*: 277-283.

Murray, C. J. L., & Lopez, A. D. (1997). Regional patterns of disability-free life expectancy and disability-adjusted life expectancy: Global burden of disease study. *The Lancet 349*: 1347-1352.

Nagi, S. Z. (1965). *Some conceptual issues in disability and rehabilitation. In Sociology and rehabilitation* (A. S. Association, Trans. Sussman, M.B. ed.). American Sociological Association, Washington, D.C.

Nagi, S. Z. (1976). An epidemiology of disability among adults in the United States. *Milbank Memorial FundQuarterly/ Health and Society 54*: 439-467.

Nagi, S. Z. (1991). *Disability in America: Toward a National Agenda for Prevention* (Pope, A.M. and Tarlov, A. R. ed.). Washington, D.C.: Division of Health Promotion and Disease Prevention, Institute of Medicine. National Academy press.

National Statistical Office. (1994). *Report of The1994 Survey of Elderly in Thailand*. Bangkok: Office of The Priminister.

National Statistical Office. (2008). *The 2007 Thai elderly: perspective and sound of statistival data*. Bangkok: National Statistical Office.

Nicholls, E. S., & Johansen, H. L. (1983). Implications of changing trends in cerebrovascular and ischemic heart disease mortality. *Stroke 14*: 153-156.

Nussdelder, W. J. (2003). Compression of the Morbidity. In Robine.J.M, Jagger. C, Mathers. C.D, Elieen. M, Crimmins. E.M & Suzman. R.M (Eds.), *Determining Health Expectancies* (pp. 35-58). England: John Wiley & Sons.

Nusselder, W. J. (1998). *Compression or expansion of morbidity: a life-table approach*. Amsterdam, the Netherlands: Erasmus Universtity Rotterdam.

Olshansky, S. J., & Ault, A. B. (1986). The fourth stage of the epidemiologic transition. *Milbank Quaterly 64*(3): 353-391.

Olshansky, S. J., Rudberg, M. A., Carnes, B. A., Cassel, C. K., & Brody, J. A. (1991a). Trading off longer life for worsening health. *Journal of aging and health 3*: 194-216.

Olshansky, S. J., Rudberg, M. A., Carnes, B. A., Cassel, C. K., & Brody, J. A. (1991b). Trading off longer life for worsening health. *Journal of aging and health* (3): 194-216.

Olshansky, S. J., Rudberg, M. A., Carnes, B. A., & et al. (1991). Trading off longer life for worsening health—the expansion of morbidity hypothesis. *Journal of Aging Health 3*: 194-216.

Oxfordshire Community Stroke Project. (1983). Incidence of stroke in Oxfordshire: the first year's experience in a community stroke register. *BMJ 287*: 713-717.

Petcharoen, P., Prasartkul, P., Gray, R., & Vapattanawong, P. (2006). Adult Mortality of Cardiovascular Disease by Socioeconomic Status in Thailand. *Journal of Public Health and Development 4*(2).

Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. (2007). World Population Prospects: The 2006 Revision (Publication.: http://esa.un.org/unpp/p2k0data.asp

Population Division of the Development of Economic and Social Affairs of the United Nations Secretariat. (2006). World Population Prospects: The 2006 Revision Population Database.

Population Reference Bureau. (2007). 2007 World Population data sheet (Publication.: http://prb.org/pdf07/07WPDS_Eng.pdf

Porapakkham, Y., & Bunyaratpun, P. (2004). *Report of National Health Examination Survey III, 2003-2004*. Nonthaburi: Thailand Health Research Institute.

Prasartkul, P., & Vapattanawong, P. (2006). The completeness of Death Registration in Thailand: Evidence from Demographic Surveillance System of the Kanchanaburi project. *World Health and Population*: 1-9.

Preston, S. (1982). 'Individual Life Cycles and population characteristics'. *American Sociological Review 47*: 253-264.

Puska, P., Sepulveda, C., & Porter, D. (2003). Global Strategy on Diet,Physical Activity and Health. *World Health Organization*.

Rakchanyaban, U. (2002). *Active life expectancy among the Thai elderly population.* Mahidol University, Bangkok.

Robine, J. M., Jagger, C., & Egidi, V. (2000). Selection of coherent set of health indicators: A first step towards a user's guide to health expectancies for the Europian Union (Publication., from Euro-REVES (online):http://www.prw.le.ac.uk/reves/userguide.1.pdf:

Robine, J. M., & Mathers, C. D. (1993). *Measuring the compression or expansion of morbidity through changes in health expectancy*. *In: Calculation of health expectancies: harmonization, consensus achieved and future perspectives*. Montrouge: John Libbey Eurotext.

Robine, J. M., Michel, J. P., & Branch, L. G. (1992). 'Measurement and utilization of healthy life expectancy: conceptual issues'. *Bulletin of the World Health Organisation 70*: 791-800.

Robine, J. M., Romieu, I., & Cambois, E. (1999). Health expectancy indicators. *Bulletiin World Health Organization 77*(2): 181-185.

Robins, M., & Baum, H. M. (1981). The national survey of stroke incidence. *Stroke 12*(Suppl): 145-157.

Saito, Y., Crimmins, E. M., & Hayward, M. D. (1999). Health expectancy: An overview. *NUPRI Research Paper series no 67*.

Saito, Y., Qiao, X., & Jitapunkul, S. (2003). Health Expectancy in Asian. In Robine.J.M, Jagger. C, Mathers. C.D, Elieen. M, Crimmins. E.M & Suzman. R.M (Eds.), *Determining Health Expectancies* (pp. 289-317). England: John Wiley & Sons.

Schoen, R. (1975). Constructing increment-decrement life table. *Demography 12*: 313-324.

Shephard, D., & Zeckhauser, R. (1980). Long-term efforts of interventions to improve survival of mixed populations. *Journal chronic disease* (33): 413-433.

Solymoss, B. C., Bourassa, M. G., Campeau, L., Sniderman, A., Marcil, M., Lesperance, J., et al. (2004). Effect of increasing metabolic syndrome score on atherosclerotic risk profile and coronary artery disease angiographic severity. *Am J Cardiol 3*: 159-164.

Stout, R. W., & Crawford, V. (1988). Active-life expectancy and terminal dependency: trends in long-term geriatric care over 33 years. *Lancet 1*: 281-283.

Strehler, B. L. (1975). Implications of aging research for society. *in Theoretical concepts of developmental and age changes. Federation Proceedings, 134*(1): 5-8.

Stunkard, A. J., & Wadden, T. A. (1993). *Obesity, theory and therapy* (2nd ed.). New York: Raven Press.

Sun, Z., Zheng, L., Wei, Y., Li, J., Zhang, X., Zhang, X., et al. (2007). Prevalence and risk factors of the rural adult people prehypertension status in Liaoning Province of China *Circ J 71*: 550-553.

Tangcharoensathien, V., Faramnuayphol, P., Teokul, W., & Bundhamcharoen, K. (2006). A critical assessment of mortality statistics in Thailand: potential for improvements. *Bulletiin World Health Organization 84*(3): 233-238.

Thailand Health Research Institute. (1997). *Report of National Health Examination Survey II, 1996-1997*. Nonthaburi: Thailand Health Research Institute.

The InterAsia Collaborative Group. (2002). Cardiovascular risk factor levels in urban and rural Thailand--The International Collaborative Study of Cardiovascular Disease in Asia (InterAsia). *European Journal of cardiovascular prevention and rehabilitation 10*(4): 249-257.

Tunstall-Pedoe, H., Vanuzzo, D., Hobbs, M., & et al. (2000). Estimation of contribution of changes in coronary care to improving survival, event rates, and coronary heart disease mortality across the WHO MONICA project populations. *Lancet 355*: 688-700.

U.S Census Bureau. (2008). Population Analysis Spreadsheets (PAS). from http://www.census.gov/ftp/pub/ipc/www/pas.html

Unger, R. (2006). Trends in active life expectancy in Germany between 1984 and 2003—a cohort analysis with different health indicators. *Journal of Public Health 14*(3): 155-163.

United Nations. (1946). *Constitution of the World Health Organization*. . Geneva: UN.

US Department of Health and Human Services. (1996). *Physical activity and health: a report of the Surgeon General*. Atlanta (GA): The Department, Center of Disease Control and Prevention, National Center for Chronic Disease Prevention and Health promotion.

Van Wijk, B. L., Klungel, O., Heerdink, E., & de Boer, A. (2004). The association between compliance with antihypertensive drugs and modification of antihypertensive drug regimen. . *J Hypertens 22*: 1831-1837.

Vathisathokit, P. (2004). Survey of Smoking Behavior in Thailand in 2004, National Statistical Office: Problem Analysis and Suggestions. 2007, from http://www.ashthailand.or.th/th/informationcenter.php?act=list&categoryID=2&p=2

Venketasubramanian, N. (1998). Trends in cerebrovascular disease mortality in Singapore: 1970-1994. *International Journal of Epidemiology 27*: 15-19.

Verbrugge, L. M. (1984). 'Longer life but worsening health? Trends in health and mortality of middle-aged and older persons'. *Milbank Memorial FundQuarterly/ Health and Society 62*: 475-519.

Verbrugge, L. M., & Jetti, A. M. (1994). The disablement process. *Society Science and Medicne 38*(1): 1-14.

Verdecchia, P., Staessen, J. A., White, W. B., Imai, Y., & O'Brien, E. T. (2002). Properly defining white coat hypertension (Vol. 23, pp. 106-109).

Wang, Y., & Wang, Q. J. (2004). The prevalence of prehypertension and hypertension among US adults according to the new Joint National Committee guidelines: new challenges of the old problem. *Arch Intern Med 2004 164*: 2126-2134.

Whitaker, R. C., Wright, J. A., Pepe, M. S., Seldel, K., D., & Dietz, W. H. (1997). Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med 337*: 869-873.

Wolf, D. A. (2001). Population change: Friend or foe of the chronic care system? *Health Affairs 20*: 28-42.

Wood, P. H. (1975). Classification of impairments and handicaps. In: World Health Organization (WHO/ICD 9/REV. CONF/75.15).

World Health Organization. (12/ 09/ 2008). Global database on body mass index. Retrieved 12/ 09/ 2008, from http://www.who.int/bmi/index.jsp?introPage=intro_3.html

World Health Organization. (1980). *International Classification of Impairments, Disabilities, and Handicaps: A manual of classification relating to the consequences of disease*. Geneva: WHO.

World Health Organization. (1984). *The uses of epidemiology in the study of the elderly: Report of a WHO sciencetific group on the epidemiology of aging*. Geneva.

World Health Organization. (1992). *International statistical of diseases and related health problems, tenth revision, 2nd ed*. Geneva: WHO.

World Health Organization. (1999). *International Classification of Functioning and Disability (ICIDH 2-Beta 2)* WHO:Geneva.

World health Organization. (2002). *The World Health Report 2002: Reducing Risks, Promoting Health Life*. Geneva: WHO.

World health Organization. (2005). *Preventing Chronic Diseases: A vital investment*. Switzerland.

Zimmer, Z., Martin, L. G., & Chang, M. C. (2002). *Changes in functional limitations and survival among the elderly in Taiwan:1993, 1996, and 1999*. New York: The Population Council.

APPENDICES

APPENDIX A

Table A1 Socioeconomic characteristics among elderly in Thailand, 2002-2007

Characteristics		2002 Male	2002 Female	2002 Total	2007 Male	2007 Female	2007 Total
Age group	60-69	45.50	54.50	100	45.30	54.70	100
	70-79	42.60	57.40	100	41.30	58.70	100
	80-89	38.20	61.80	100	38.90	61.10	100
	90+	31.40	68.60	100	32.60	67.40	100
Area	Urban	43.90	56.10	100	42.10	57.90	100
	Rural	46.00	54.00	100	44.30	55.70	100
Marital status	Single	22.90	77.10	100	18.80	81.20	100
	Married	56.00	44.00	100	58.70	41.30	100
	Widow	18.40	81.60	100	19.30	80.70	100
	divorce/separate	30.20	69.80	100	33.50	66.50	100
Education	no school	27.20	72.80	100	26.30	73.70	100
	Undergraduate	47.30	52.70	100	46.10	53.90	100
	Graduate/ higher	57.10	42.90	100	58.60	41.40	100
Income	<10000	33.50	66.50	100	41.70	58.30	100
	10000-19999	37.70	62.30	100	35.20	64.80	100
	20000-49999	44.00	56.00	100	37.90	62.10	100
	>=50000	55.20	44.80	100	42.50	57.50	100
Work	Work	54.50	45.50	100	56.40	43.60	100
	non work	33.20	66.80	100	35.90	64.10	100

Table A2 Percent of disability by socioeconomic character among elderly in Thailand, 2002-2007

Characteristics		% disability (2002)				% disability (2007)		
		Male	Female	Total		Male	Female	Total
Area	Urban	2.10	2.40	2.30		4.10	5.10	4.70
	Rural	1.50	2.10	1.90		2.90	4.10	3.60
Marital status	Single	2.10	1.80	1.90		3.00	2.80	2.90
	Married	1.70	1.30	1.50		3.00	2.70	2.90
	Widow	3.50	3.80	3.80		6.50	6.80	6.70
	Divorce/separate	0.80	0.60	0.70		3.20	2.70	2.80
Education	no school	2.80	5.00	4.40		6.00	8.50	7.90
	Undergraduate	1.80	1.70	1.70		3.30	3.60	3.50
	Graduated/ higher	0.60	0.20	0.40		2.50	1.90	2.20
Income	<10000	5.40	5.30	5.30		0.00	28.60	16.70
	10000-19999	2.10	2.10	2.10		5.80	7.80	7.10
	20000-49999	1.30	1.60	1.50		4.10	4.50	4.30
	>=50000	1.10	1.10	1.10		3.10	3.60	3.40
Work	Work	0.30	0.30	0.30		0.60	0.30	0.50
	non work	4.10	3.60	3.80		6.00	6.30	6.20

APPENDIX B

Table B1 Life expectancy at birth by sex (year) in Thailand, 1990-2010

Period	Both sexes combined	Male	Female
1990-1995	67.3	64.0	71.2
1995-2000	67.5	62.8	72.8
2000-2025	68.6	63.7	74.0
2005-2010	70.6	66.5	75.0

Source: Population Division of the Development of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2006 Revision Population Database

Table B2 The west model life table by sex (level 19-20)

LIFE TABLES

MODEL WEST

LEVEL 19

FEMALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	50.35	5035	52.47	100000	95977.	0.94230 (1)	6500000.	65.000	0
1	19.26	1831	4.88	94965	375174.	0.98459 (2)	6404023.	67.436	1
5	6.94	646	1.39	93134	463890.	0.99427	6028849.	64.733	5
10	5.42	501	1.09	92487	461233.	0.99321	5564958.	60.170	10
15	8.28	762	1.66	91986	458101.	0.99032	5103726.	55.484	15
20	11.20	1022	2.25	91224	453668.	0.98787	4645625.	50.925	20
25	13.15	1186	2.65	90202	448165.	0.98581	4191957.	46.473	25
30	15.33	1364	3.09	89016	441807.	0.98321	3743792.	42.057	30
35	18.41	1613	3.71	87652	434388.	0.97945	3301984.	37.672	35
40	22.92	1972	4.63	86039	425461.	0.97351	2867597.	33.329	40
45	30.45	2559	6.18	84067	414192.	0.96355	2442135.	29.050	45
50	43.16	3518	8.82	81508	399094.	0.94812	2027943.	24.880	50
55	61.75	4816	12.73	77989	378389.	0.92314	1628849.	20.886	55
60	94.31	6901	19.76	73174	349305.	0.88220	1250460.	17.089	60
65	145.89	9668	31.38	66272	308157.	0.81710	901154.	13.598	65
70	229.85	13010	51.67	56604	251795.	0.71400	592997.	10.476	70
75	350.40	15275	84.97	43594	179781.	0.58313	341202.	7.827	75
80	501.95	14215	135.59	28319	104836.	0.42092	161422.	5.700	80
85	677.80	9560	216.64	14104	44128.	0.25248	56586.	4.012	85
90	841.22	3823	343.12	4544	11141.	0.11432	12458.	2.741	90
95	949.71	685	538.02	722	1274.	0.03277 (3)	1317.	1.825	95
100	1000.00	36	840.82	36	43.	0.0	43.	1.189	100

MALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	63.34	6334	66.61	100000	95089.	0.92938 (1)	6122213.	61.222	0
1	21.29	1994	5.40	93666	369603.	0.98196 (2)	6027124.	64.347	1
5	8.14	746	1.63	91672	456308.	0.99335	5657521.	61.715	5
10	6.21	565	1.25	90926	453274.	0.99186	5201212.	57.203	10
15	10.24	925	2.06	90361	449585.	0.98775	4747938.	52.544	15
20	14.45	1292	2.91	89436	444078.	0.98521	4298354.	48.061	20
25	15.18	1338	3.06	88144	437508.	0.98386	3854276.	43.727	25
30	17.19	1493	3.47	86806	430448.	0.98087	3416768.	39.361	30
35	21.27	1o14	4.30	85314	422213.	0.97528	2986319.	35.004	35
40	28.54	2383	5.79	83499	411777.	0.96587	2564106.	30.708	40
45	40.37	3274	8.23	81116	397723.	0.95090	2152329.	26.534	45
50	58.96	4589	12.14	77842	378195.	0.92805	1754606.	22.541	50
55	86.91	6367	18.14	73253	350983.	0.89386	1376410.	18.790	55
60	128.95	8625	27.49	66886	313729.	0.84417	1025428.	15.331	60
65	189.25	11026	41.63	5826	264842.	0.77264	711698.	12.216	65
70	278.30	13145	64.24	47235	204626.	0.66572	446857.	9.460	70
75	401.59	13690	100.50	34090	136223.	0.53072	242231.	7.106	75
80	551.58	11252	155.63	20400	72297.	0.37566	106008.	5.197	80
85	718.87	6576	242.13	9148	27159.	0.21934	33711.	3.685	85
90	865.70	2226	373.74	2572	5957.	0.09712	6552.	2.548	90
95	958.27	331	572.08	345	579.	0.02772 (3)	595.	1.723	95
100	1000.00	14	873.76	14	16.	0.0	16.	1.144	100

LEVEL 20

FEMALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	40.69	4069	42.10	100000	96631.	0.95442 (1)	6750000.	67.500	0
1	12.91	1239	3.25	95931	380576.	0.98939 (2)	6653369.	69.356	1
5	5.07	480	1.02	94693	472143.	0.99581	6272792.	66.244	5
10	3.97	374	0.80	94212	470164.	0.99490	5800650.	61.570	10
15	6.33	594	1.27	93838	467765.	0.99251	5330486.	56.805	15
20	8.74	815	1.76	93244	464263.	0.99047	4862720.	52.151	20
25	10.39	960	2.09	92429	459838.	0.98873	4398457.	47.588	25
30	12.23	1119	2.46	91468	454655.	0.98643	3938619.	43.060	30
35	15.04	1359	3.03	90349	448485.	0.98290	3483964.	38.561	35
40	19.37	1724	3.91	88990	440816.	0.97711	3035479.	34.110	40
45	26.77	2336	5.42	87267	430727.	0.96763	2594664.	29.733	45
50	38.59	3278	7.86	84931	416787.	0.95311	2163936.	25.479	50
55	56.24	4592	11.56	81653	397244.	0.92956	1747149.	21.397	55
60	86.73	6683	18.10	77061	369263.	0.89029	1349906.	17.517	60
65	136.97	9640	29.32	70377	328751.	0.82664	980642.	13.934	65
70	219.03	13303	48.95	60737	271760.	0.72493	651892.	10.733	70
75	338.71	16066	81.55	47434	197005.	0.59556	380132.	8.014	75
80	489.38	15351	130.84	31368	117328.	0.43298	183127.	5.838	80
85	666.09	10569	210.01	16017	50801.	0.26247	65799.	4.108	85
90	833.05	4455	334.14	5348	13334.	0.12041	14998.	2.804	90
95	946.14	845	526.18	893	1606.	0.03501 (3)	1664.	1.863	95
100	1000.00	48	825.66	48	58.	0.0	58.	1.211	100

MALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	52.33	5233	54.64	100000	95777.	0.94261 (1)	6363701.	63.637	0
1	14.91	1413	3.76	94767	375528.	0.98689 (2)	6267924.	66.140	1
5	6.39	597	1.28	93353	465126.	0.99473	5892397.	63.119	5
10	4.97	461	1.00	92757	462677.	0.99333	5427271.	58.511	10
15	8.53	787	1.71	92296	459590.	0.98981	4964594.	53.790	15
20	12.01	1099	2.42	91509	454906.	0.98778	4505004.	49.230	20
25	12.44	1125	2.50	90410	449349.	0.98680	4050098.	44.797	25
30	14.04	1254	2.83	89285	443417.	0.98427	3600748.	40.329	30
35	17.59	1548	3.55	88031	436441.	0.97928	3157332.	35.866	35
40	24.18	2092	4.89	86483	427396.	0.97044	2720890.	31.461	40
45	35.52	2998	7.23	84392	414763.	0.95615	2293494.	27.177	45
50	53.20	4331	10.92	81394	396576.	0.93403	1878731.	23.082	50
55	80.58	6209	16.76	77063	370414.	0.90080	1482155.	19.233	55
60	121.14	8583	25.72	70854	333669.	0.85236	1111741.	15.691	60
65	180.29	11227	39.47	62271	284408.	0.78186	778072.	12.495	65
70	268.15	13688	61.55	51044	222368.	0.67602	493664.	9.671	70
75	390.35	14582	97.00	37356	150326.	0.54242	271296.	7.262	75
80	540.21	12303	150.88	22774	81539.	0.38632	120970.	5.312	80
85	708.79	7422	235.62	10471	31500.	0.22780	39431.	3.766	85
90	858.99	2619	365.03	3049	7176.	0.10211	7931.	2.601	90
95	955.41	411	560.67	.30	733.	0.02955 (3)	755.	1.756	95
100	1000.00	19	859.14	19	22.	0.0	22.	1.164	100

(1) P(birth), (2) P(0-4), (3) T(100)/T(95)

Souce: Regional mode life tables and stable population, 1983 ({Coale AJ and Demmy P)

Table B3 The west model life table by sex (level 21-22)

MODEL WEST — LIFE TABLES

LEVEL 21
FEMALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	31.16	3116	32.02	100000	97331.	0.96591 (1)	7000000.	70.000	0
1	7.81	757	1.96	96884	385622.	0.99333 (2)	6902669.	71.247	1
5	3.42	329	0.68	96127	479731.	0.99714	6517047.	67.796	5
10	2.75	263	0.55	95798	478360.	0.99645	6037316.	63.021	10
15	4.42	423	0.89	95535	476661.	0.99466	5558956.	58.188	15
20	6.34	603	1.27	95112	474115.	0.99302	5082294.	53.435	20
25	7.69	726	1.54	94510	470805.	0.99160	4608179.	48.759	25
30	9.18	861	1.84	93783	466850.	0.98962	4137374.	44.116	30
35	11.70	1087	2.35	92922	462004.	0.98631	3670524.	39.501	35
40	15.88	1458	3.20	91836	455679.	0.98070	3208520.	34.938	40
45	23.07	2085	4.66	90377	446884.	0.97173	2752841.	30.459	45
50	34.04	3006	6.92	88293	434250.	0.95815	2305957.	26.117	50
55	50.61	4316	10.37	85287	416077.	0.93609	1871707.	21.946	55
60	79.10	6404	16.44	80971	389485.	0.89855	1455629.	17.977	60
65	127.75	9526	27.22	74567	349971.	0.83656	1066144.	14.298	65
70	207.77	13513	46.16	65041	292772.	0.73635	716173.	11.011	70
75	326.47	16822	78.03	51527	215582.	0.60864	423401.	8.217	75
80	476.02	16520	125.91	34705	131212.	0.44588	207820.	5.988	80
85	653.47	11883	203.11	18185	58505.	0.27332	76608.	4.213	85
90	824.09	5193	324.76	6302	15991.	0.12712	18102.	2.873	90
95	942.13	1044	513.80	1109	2033.	0.03751 (3)	2112.	1.905	95
100	1000.00	64	809.80	64	79.	0.0	79.	1.235	100

MALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	41.34	4134	42.82	100000	96533.	0.95540 (1)	6602961.	66.030	0
1	9.70	930	2.44	95866	381168.	0.99105 (2)	6506428.	67.870	1
5	4.81	456	0.96	94937	473428.	0.99598	6125259.	64.519	5
10	3.85	364	0.77	94480	471527.	0.99470	5651831.	59.820	10
15	6.88	647	1.38	94116	469027.	0.99181	5180304.	55.042	15
20	9.63	900	1.94	93469	465184.	0.99026	4711276.	50.405	20
25	9.85	912	1.98	92569	460654.	0.98953	4246093.	45.870	25
30	11.15	1022	2.24	91657	455829.	0.98740	3785438.	41.300	30
35	14.17	1285	2.85	90634	450088.	0.98294	3329609.	36.737	35
40	20.24	1808	4.09	89349	442407.	0.97466	2879522.	32.228	40
45	30.99	2712	6.29	87541	431196.	0.96107	2437114.	27.840	45
50	47.81	4055	9.79	84829	414410.	0.93982	2005919.	23.647	50
55	74.27	5999	15.40	80773	389469.	0.90777	1591509.	19.703	55
60	113.24	8468	23.95	74774	353550.	0.86075	1202040.	16.076	60
65	171.03	11340	37.27	66307	304317.	0.79147	848490.	12.796	65
70	257.54	14156	58.77	54966	240857.	0.68684	544174.	9.900	70
75	378.54	15448	93.38	40810	165429.	0.55476	303317.	7.432	75
80	528.10	13394	145.94	25362	91773.	0.39774	137888.	5.437	80
85	697.91	8353	228.83	11968	36502.	0.23700	46114.	3.853	85
90	851.62	3079	355.92	3616	8651.	0.10762	9612.	2.659	90
95	952.22	511	548.72	536	931.	0.03160 (3)	961.	1.792	95
100	1000.00	26	843.81	26	30.	0.0	30.	1.185	100

LEVEL 22
FEMALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	22.82	2282	23.29	100000	97988.	0.97542 (1)	7250000.	72.500	0
1	4.69	458	1.18	97718	389720.	0.99589 (2)	7152012.	73.190	1
5	2.23	217	0.45	97260	485702.	0.99812	6762291.	69.528	5
10	1.82	176	0.36	97043	484791.	0.99763	6276589.	64.679	10
15	2.96	287	0.59	96867	483644.	0.99646	5791798.	59.791	15
20	4.16	402	0.83	96580	481934.	0.99536	5308153.	54.961	20
25	5.16	497	1.04	96178	479697.	0.99422	4826219.	50.180	25
30	6.45	617	1.29	95681	476925.	0.99250	4346522.	45.427	30
35	8.63	821	1.73	95064	473350.	0.98960	3869597.	40.705	35
40	12.33	1162	2.48	94243	468426.	0.98453	3396248.	36.037	40
45	18.92	1761	3.82	93081	461177.	0.97647	2927822.	31.455	45
50	28.63	2614	5.81	91320	450324.	0.96426	2466645.	27.011	50
55	43.68	3874	8.92	88705	434229.	0.94431	2016322.	22.731	55
60	69.29	5878	14.34	84831	410048.	0.90948	1582093.	18.650	60
65	115.24	9098	24.40	78953	372930.	0.85041	1172045.	14.845	65
70	191.66	13388	42.21	69855	317143.	0.75306	799115.	11.440	70
75	308.18	17402	72.86	56467	238828.	0.62832	481972.	8.536	75
80	455.69	17801	118.63	39065	150060.	0.46569	243144.	6.224	80
85	633.89	13479	192.88	21263	69882.	0.29027	93084.	4.378	85
90	809.87	6305	310.80	7785	20285.	0.13782	23202.	2.980	90
95	935.59	1385	495.31	1480	2796.	0.04157 (3)	2917.	1.971	95
100	1000.00	95	786.15	95	121.	0.0	121.	1.272	100

MALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	30.99	3099	31.85	100000	97309.	0.96690 (1)	6856974.	68.570	0
1	6.18	599	1.55	96901	386142.	0.99409 (2)	6759666.	69.759	1
5	3.45	332	0.69	96302	480595.	0.99708	6373524.	66.183	5
10	2.84	272	0.57	95969	479193.	0.99600	5892929.	61.404	10
15	5.27	504	1.06	95697	477275.	0.99374	5413736.	56.572	15
20	7.34	699	1.47	95193	474287.	0.99264	4936461.	51.857	20
25	7.39	698	1.48	94494	470794.	0.99215	4462174.	47.222	25
30	8.35	783	1.68	93796	467100.	0.99050	3991380.	42.554	30
35	10.77	1001	2.16	93013	462661.	0.98678	3524280.	37.890	35
40	15.91	1464	3.21	92012	456544.	0.97948	3061618.	33.274	40
45	25.59	2317	5.18	90548	447177.	0.96716	2605074.	28.770	45
50	40.91	3610	8.35	88231	432490.	0.94733	2157897.	24.457	50
55	65.95	5581	13.62	84621	409710.	0.91712	1725407.	20.390	55
60	102.52	8103	21.56	79040	375752.	0.87229	1315697.	16.646	60
65	158.13	11217	34.22	70937	327763.	0.80512	939945.	13.250	65
70	242.17	14463	54.81	59720	263889.	0.70272	612182.	10.251	70
75	361.00	16338	88.10	45257	185441.	0.57321	348293.	7.696	75
80	509.78	14742	138.69	28919	106297.	0.41516	162851.	5.631	80
85	681.16	9657	218.82	14177	44130.	0.25125	56554.	3.989	85
90	840.03	3797	342.46	4520	11088.	0.11631	12424.	2.749	90
95	947.06	685	531.01	723	1290.	0.03489 (3)	1336.	1.848	95
100	1000.00	38	821.10	38	47.	0.0	47.	1.218	100

(1) P(birth), (2) P(0-4), (3) T(100)/T(95)

Souce: Regional mode life tables and stable population, 1983 ({Coale AJ and Demmy P)

Table B4 The west model life table by sex (level 23-24)

LIFE TABLES

MODEL WEST

LEVEL 23

FEMALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	15.30	1530	15.51	100000	98617.	0.98379 (1)	7500000.	75.000	0
1	2.44	240	0.61	98470	393280.	0.99777 (2)	7401383.	75.164	1
5	1.29	127	0.26	98230	490802.	0.99891	7008103.	71.344	5
10	1.07	105	0.21	98103	490266.	0.99859	6517301.	66.433	10
15	1.79	175	0.36	97999	489572.	0.99784	6027035.	61.501	15
20	2.56	250	0.51	97823	488516.	0.99711	5537462.	56.607	20
25	3.25	317	0.65	97573	487105.	0.99631	5048946.	51.745	25
30	4.18	406	0.84	97256	485305.	0.99501	4561842.	46.905	30
35	5.86	568	1.18	96850	482886.	0.99267	4076536.	42.091	35
40	8.92	859	1.79	96282	479348.	0.98833	3593650.	37.324	40
45	14.67	1400	2.96	95423	473755.	0.98140	3114302.	32.637	45
50	22.92	2155	4.64	94023	464942.	0.97080	2640547.	28.084	50
55	36.16	3322	7.36	91868	451366.	0.95334	2175605.	23.682	55
60	58.47	5177	12.03	88546	430305.	0.92172	1724239.	19.473	60
65	101.07	8426	21.24	83369	396621.	0.86626	1293934.	15.521	65
70	173.11	12973	37.76	74943	343578.	0.77256	897313.	11.973	70
75	286.67	17765	66.93	61970	265435.	0.65168	553735.	8.936	75
80	431.17	19060	110.19	44204	172978.	0.48985	288300.	6.522	80
85	609.72	15331	180.93	25145	84734.	0.31147	115322.	4.586	85
90	791.77	7770	294.41	9814	26392.	0.15157	30588.	3.117	90
95	926.96	1894	473.55	2044	4000.	0.04689 (3)	4197.	2.054	95
100	1000.00	149	758.39	149	197.	0.0	197.	1.319	100

MALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	21.62	2162	22.04	100000	98065.	0.97720 (1)	7120375.	71.204	0
1	3.47	339	0.87	97838	390535.	0.99650 (2)	7022310.	71.775	1
5	2.26	220	0.45	97499	486890.	0.99806	6631775.	68.019	5
10	1.92	186	0.38	97279	485948.	0.99721	6144885.	63.168	10
15	3.74	363	0.75	97093	484591.	0.99557	5658937.	58.284	15
20	5.18	502	1.04	96729	482443.	0.99485	5174346.	53.493	20
25	5.11	491	1.02	96228	479960.	0.99458	4691903.	48.758	25
30	5.75	551	1.15	95736	477360.	0.99338	4211943.	43.995	30
35	7.56	720	1.52	95186	474200.	0.99047	3734583.	39.235	35
40	11.69	1104	2.35	94466	469679.	0.98434	3260383.	34.514	40
45	20.02	1869	4.04	93362	462323.	0.97358	2790705.	29.891	45
50	33.50	3065	6.81	91493	450108.	0.95559	2328382.	25.449	50
55	56.64	5008	11.64	88428	430119.	0.92772	1878274.	21.241	55
60	90.23	7527	18.86	83419	399032.	0.88569	1448155.	17.360	60
65	142.99	10851	30.70	75892	353417.	0.82127	1049124.	13.824	65
70	223.92	14564	50.18	65041	290250.	0.72179	695707.	10.696	70
75	339.84	17154	81.88	50477	209498.	0.59567	405457.	8.033	75
80	487.14	16233	130.08	33323	124792.	0.43691	195958.	5.881	80
85	659.99	11279	206.87	17090	54522.	0.26945	71166.	4.164	85
90	824.97	4794	326.29	5811	14691.	0.12770	16644.	2.864	90
95	940.12	956	509.69	1017	1876.	0.03929 (3)	1953.	1.920	95
100	1000.00	61	793.78	61	77.	0.0	77.	1.260	100

LEVEL 24

FEMALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	9.05	905	9.13	100000	99164.	0.99057 (1)	7750000.	77.500	0
1	1.04	103	0.26	99095	396122.	0.99899 (2)	7650836.	77.207	1
5	0.63	62	0.13	98992	494788.	0.99946	7254713.	73.286	5
10	0.53	53	0.11	98930	494522.	0.99928	6759925.	68.331	10
15	0.92	91	0.18	98877	494166.	0.99887	6265403.	63.366	15
20	1.35	134	0.27	98786	493608.	0.99845	5771237.	58.422	20
25	1.77	175	0.35	98652	492842.	0.99795	5277629.	53.497	25
30	2.36	233	0.47	98478	491829.	0.99708	4784788.	48.588	30
35	3.53	347	0.71	98245	490392.	0.99537	4292958.	43.697	35
40	5.83	571	1.17	97898	488120.	0.99193	3802567.	38.842	40
45	10.51	1023	2.11	97327	484179.	0.98633	3314447.	34.055	45
50	17.13	1650	3.45	96304	477559.	0.97759	2830268.	29.389	50
55	28.22	2671	5.72	94654	466859.	0.96299	2352709.	24.856	55
60	46.80	4305	9.58	91983	449581.	0.93527	1885850.	20.502	60
65	85.10	7462	17.75	87678	420481.	0.88451	1436268.	16.381	65
70	151.48	12151	32.67	80216	371918.	0.79576	1015788.	12.663	70
75	260.73	17747	59.96	68065	295959.	0.68016	643869.	9.460	75
80	400.74	20165	100.17	50318	201298.	0.52028	347911.	6.914	80
85	578.79	17453	166.64	30154	104732.	0.33896	146613.	4.862	85
90	767.76	9751	274.68	12701	35500.	0.16998	41881.	3.297	90
95	915.01	2699	447.27	2950	6035.	0.05420 (3)	6380.	2.163	95
100	1000.00	251	724.96	251	346.	0.0	346.	1.379	100

MALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	13.48	1348	13.65	100000	98762.	0.98598 (1)	7390508.	73.905	0
1	1.63	160	0.41	98652	394226.	0.99822 (2)	7291746.	73.914	1
5	1.29	127	0.26	98492	492109.	0.99887	6897521.	70.031	5
10	1.15	113	0.23	98364	491552.	0.99826	6405412.	65.119	10
15	2.39	235	0.48	98252	490696.	0.99718	5913860.	60.191	15
20	3.29	322	0.66	98017	489313.	0.99678	5423164.	55.329	20
25	3.15	307	0.63	97695	487738.	0.99667	4933852.	50.503	25
30	3.53	344	0.71	97388	486113.	0.99588	4446114.	45.654	30
35	4.76	462	0.95	97044	484109.	0.99379	3960001.	40.806	35
40	7.80	753	1.57	96581	481100.	0.98899	3475893.	35.989	40
45	14.51	1390	2.92	95828	475805.	0.98012	2994792.	31.252	45
50	25.78	2434	5.22	94438	466348.	0.96446	2518987.	26.673	50
55	46.39	4268	9.49	92004	449776.	0.93959	2052639.	22.310	55
60	76.33	6697	15.85	87736	422607.	0.90113	1602864.	18.269	60
65	125.31	10155	26.67	81039	380823.	0.84041	1180257.	14.564	65
70	202.06	14323	44.75	70884	320045.	0.74493	799434.	11.278	70
75	313.96	17758	74.49	56561	238411.	0.62342	479389.	8.476	75
80	458.66	17798	119.74	38803	148630.	0.46463	240977.	6.210	80
85	632.60	13288	192.42	21006	69057.	0.29330	92347.	4.396	85
90	804.79	6211	306.64	7717	20254.	0.14308	23290.	3.018	90
95	930.43	1402	483.68	1507	2898.	0.04540 (3)	3036.	2.015	95
100	1000.00	105	760.49	105	138.	0.0	138.	1.315	100

(1) P(birth), (2) P(0-4), (3) T(100)/T(95)

Souce: Regional mode life tables and stable population, 1983 ({Coale AJ and Demmy P)

Table B5 The west model life table by sex (level 25)

MODEL WEST

LIFE TABLES

LEVEL 25

FEMALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	4.45	445	4.47	100000	99583.	0.99544 (1)	8000000.	80.000	0
1	0.32	[illegible]	0.08	99555	398138.	0.99965 (2)	7900417.	79.358	1
5	0.24	24	0.05	99522	497547.	0.99979	7502279.	75.383	5
10	0.21	21	0.04	99499	497444.	0.99971	7004732.	70.400	10
15	0.38	38	0.08	99478	497300.	0.99953	6507288.	65.414	15
20	0.57	57	0.11	99440	497066.	0.99933	6009988.	60.438	20
25	0.78	77	0.16	99384	496733.	0.99907	5512922.	55.471	25
30	1.09	109	0.22	99306	496272.	0.99858	5016189.	50.512	30
35	1.78	176	0.36	99198	495567.	0.99750	4519917.	45.565	35
40	3.28	325	0.66	99022	494329.	0.99508	4024350.	40.641	40
45	6.70	661	1.34	98697	491897.	0.99098	3530022.	35.766	45
50	11.55	1132	2.32	98036	487461.	0.98433	3038125.	30.990	50
55	20.18	1956	4.08	96904	479824.	0.97296	2550663.	26.322	55
60	34.63	3288	7.04	94948	466848.	0.94991	2070839.	21.810	60
65	67.43	6181	13.94	91660	443465.	0.90527	1603992.	17.499	65
70	126.45	10809	26.92	85479	401454.	0.82337	1160527.	13.577	70
75	229.32	17123	51.80	74670	330544.	0.71510	759072.	10.166	75
80	362.56	20865	88.27	57547	236373.	0.55917	428528.	7.447	80
85	538.55	19756	149.47	36683	132171.	0.37542	192156.	5.238	85
90	735.07	12443	250.76	16927	49619.	0.19541	59984.	3.544	90
95	897.85	4026	415.27	4484	9696.	0.06456 (3)	10365.	2.311	95
100	1000.00	458	684.52	458	669.	0.0	669.	1.461	100

MALES

Age(x)	1000 q(x)	d(x)	1000 m(x)	l(x)	L(x)	P(x)	T(x)	e(x)	Age(x)
0	7.11	711	7.16	100000	99334.	0.99270 (1)	7664660.	76.647	0
1	0.58	58	0.15	99289	397018.	0.99927 (2)	7565326.	76.195	1
5	0.61	60	0.12	99231	495989.	0.99945	7168308.	72.239	5
10	0.57	57	0.11	99171	495717.	0.99908	6672319.	67.281	10
15	1.30	129	0.26	99114	495260.	0.99847	6176602.	62.318	15
20	1.77	175	0.35	98985	494504.	0.99829	5681342.	57.396	20
25	1.63	161	0.33	98810	493660.	0.99827	5186838.	52.493	25
30	1.83	180	0.37	96648	492808.	0.99783	4693178.	47.575	30
35	2.55	251	0.51	98468	491738.	0.99651	4200369.	42.657	35
40	4.51	443	0.90	98217	490024.	0.99316	3708631.	37.759	40
45	9.39	918	1.89	97775	486670.	0.98646	3218607.	32.919	45
50	18.08	1751	3.65	96857	480081.	0.97368	2731937.	28.206	50
55	35.40	3367	7.20	95106	467446.	0.95261	2251856.	23.677	55
60	60.86	5583	12.54	91738	445292.	0.91873	1784410.	19.451	60
65	104.82	9031	22.07	86155	409102.	0.86305	1339118.	15.543	65
70	175.83	13561	38.41	77124	353077.	0.77320	930016.	12.059	70
75	282.05	17928	65.67	63564	272999.	0.65807	576939.	9.077	75
80	422.30	19272	107.27	45636	179653.	0.50061	303940.	6.660	80
85	596.40	15723	174.83	26364	89935.	0.32535	124287.	4.714	85
90	776.95	8267	282.53	10640	29260.	0.16457	34351.	3.228	90
95	916.34	2175	451.62	2373	4815.	0.05419 (3)	5091.	2.145	95
100	1000.00	199	719.59	199	276.	0.0	276.	1.390	100

(1) P(birth), (2) P(0-4), (3) T(100)/T(95)

Souce: Regional mode life tables and stable population, 1983 ({Coale AJ and Demmy P)

APPENDIX C

Table C1 Abridged Life Table for the male population in Thailand, 2002

Age Interval	Proportion of persons alive at Beginning of age interval dying during the age Interval ${}_nq_x$ [1]	Number living at Beginning Of age l_x [2]	Number Dying During The age d_x [3]	Years lived: In the Age L_x [4]	Years lived: In this and all Subsequent Age T_x $L_x+L_{x+1}+L_{x+2}$……… [5]	Average Number of years of life Remaining at Beginning of the age e_x [5] / [2] [6]
Male						
0 - 1	0.05032	100,000	5,032	96,478	6,399,900	64.00*
1 - 4	0.01388	94,968	1,319	375,125	6,303,422	66.37
5 - 9	0.00610	93,649	571	466,819	5,928,297	63.30
10 - 14	0.00476	93,078	443	464,283	5,461,478	58.68
15 - 19	0.00823	92,635	762	461,269	4,997,195	53.95
20 - 24	0.01157	91,873	1,063	456,705	4,535,926	49.37
25 - 29	0.01197	90,809	1,087	451,330	4,079,221	44.92
30 - 34	0.01351	89,723	1,212	445,583	3,627,892	40.43
35 - 39	0.01697	88,511	1,502	438,797	3,182,309	35.95
40 - 44	0.02348	87,008	2,043	429,934	2,743,512	31.53
45 - 49	0.03472	84,966	2,950	417,452	2,313,578	27.23
50 - 54	0.05226	82,015	4,286	399,361	1,896,125	23.12
55 - 59	0.07950	77,729	6,179	373,197	1,496,764	19.26
60 - 64	0.11979	71,550	8,571	336,321	1,123,567	15.70
65 - 69	0.17872	62,979	11,256	286,754	787,246	12.50
70 - 74	0.26636	51,723	13,777	224,172	500,493	9.68
75 - 79	0.38837	37,946	14,737	152,888	276,320	7.28
80+	1.00000	23,209	23,209	123,433	123,433	5.32

* estimated E_0 = 63.7

Table C2 Abridged Life Table for female Population in Thailand, 2002

Age Interval	Proportion of persons Alive at Beginning of age interval dying During the age Interval $_nq_x$	Number living at Beginning of age l_x	Number Dying During The age d_x	Years lived: In the Age L_x	Years lived: In this and all subsequent Age T_x	Average number of years of life remaining at Beginning of the age e_x
					$L_x+L_{x+1}+L_{x+2}$……….	[5] / [2]
	[1]	[2]	[3]	[4]	[5]	[6]
Female						
0 - 1	0.0181	100,000	1,806	98,736	7,400,000	74.00
1 - 4	0.0032	98,194	314	391,644	7,301,264	74.36
5 - 9	0.0016	97,879	158	489,001	6,909,621	70.59
10 - 14	0.0013	97,721	130	488,279	6,420,620	65.70
15 - 19	0.0022	97,591	215	487,415	5,932,340	60.79
20 - 24	0.0031	97,375	305	486,115	5,444,925	55.92
25 - 29	0.0039	97,070	382	484,397	4,958,811	51.08
30 - 34	0.0050	96,688	484	482,231	4,474,414	46.28
35 - 39	0.0069	96,204	662	479,366	3,992,183	41.50
40 - 44	0.0102	95,542	975	475,274	3,512,817	36.77
45 - 49	0.0163	94,567	1,542	468,982	3,037,543	32.12
50 - 54	0.0251	93,026	2,338	459,281	2,568,561	27.61
55 - 59	0.0391	90,687	3,547	444,568	2,109,279	23.26
60 - 64	0.0627	87,140	5,467	422,033	1,664,711	19.10
65 - 69	0.1067	81,673	8,717	386,573	1,242,678	15.22
70 - 74	0.1806	72,956	13,175	331,844	856,105	11.73
75 - 79	0.2954	59,782	17,660	254,757	524,261	8.77
80+	1.0000	42,121	42,121	269,504	269,504	6.40

Table C3 Abridged Life Table for male population in Thailand, 2007

Age Interval	Proportion of persons Alive at Beginning of age interval dying during the age Interval $_nq_x$ [1]	Number living at Beginning of age l_x [2]	Number Dying During The age d_x [3]	Years lived: In the Age L_x [4]	Years lived: In this and all subsequent Age T_x $L_x+L_{x+1}+L_{x+2}$……… [5]	Average number of years of life remaining at Beginning of the age e_x [5] / [2] [6]
Male						
0 - 1	0.0391	100,000	3,906	97,266	6,650,002	66.50
1 - 4	0.0089	96,094	853	381,307	6,552,736	68.19
5 - 9	0.0045	95,242	429	475,135	6,171,429	64.80
10 - 14	0.0036	94,813	344	473,203	5,696,293	60.08
15 - 19	0.0065	94,469	617	470,802	5,223,090	55.29
20 - 24	0.0091	93,852	857	467,119	4,752,288	50.64
25 - 29	0.0093	92,995	866	462,813	4,285,169	46.08
30 - 34	0.0105	92,130	970	458,224	3,822,356	41.49
35 - 39	0.0134	91,160	1,224	452,739	3,364,132	36.90
40 - 44	0.0193	89,936	1,736	445,340	2,911,393	32.37
45 - 49	0.0298	88,200	2,632	434,420	2,466,054	27.96
50 - 54	0.0464	85,568	3,967	417,922	2,031,634	23.74
55 - 59	0.0734	81,601	5,989	393,031	1,613,712	19.78
60 - 64	0.1110	75,612	8,396	357,068	1,220,681	16.14
65 - 69	0.1684	67,216	11,319	307,779	863,613	12.85
70 - 74	0.2544	55,896	14,222	243,926	555,834	9.94
75 - 79	0.3750	41,674	15,628	169,300	311,908	7.48
80+	1.0000	26,046	26,046	142,608	142,608	5.48

Table C4 Abridged Life Table for female population in Thailand, 2007

Age Interval	Proportion of persons Alive at Beginning of age interval dying During the age Interval **$_nq_x$**	Number living at beginning Of age **l_x**	Number Dying During The age **d_x**	Years lived: In the Age **L_x**	Years lived: In this And all Subsequent Age **T_x** **$L_x+L_{x+1}+L_{x+2}$.........**	Average Number of years of life Remaining at Beginning of the age **e_x** **[5] / [2]**
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**
Female						
0 - 1	0.01530	100000	1530	98617	7500000	75.00
1 - 4	0.00244	98470	240	393280	7401383	75.16
5 - 9	0.00129	98230	127	490802	7008103	71.34
10 - 14	0.00107	98103	105	490266	6517301	66.43
15 - 19	0.00179	97999	175	489572	6027035	61.50
20 - 24	0.00256	97823	250	488516	5537462	56.61
25 - 29	0.00325	97573	317	487105	5048947	51.75
30 - 34	0.00418	97256	406	485305	4561842	46.91
35 - 39	0.00586	96850	568	482886	4076536	42.09
40 - 44	0.00892	96282	859	479348	3593650	37.32
45 - 49	0.01467	95423	1400	473755	3114302	32.64
50 - 54	0.02292	94023	2155	464942	2640547	28.08
55 - 59	0.03616	91868	3322	451366	2175605	23.68
60 - 64	0.05847	88546	5177	430305	1724239	19.47
65 - 69	0.10107	83369	8426	396621	1293934	15.52
70 - 74	0.17311	74943	12973	343578	897313	11.97
75 - 79	0.28667	61970	17765	265435	553735	8.94
80+	1.00000	44204	44204	288300	288300	6.52

APPENDIX D

Table D1 Active life expectancy for the male population in Thailand, 2002

Age Interval	Number living at Beginning of age Interval	Years lived		Life Expectancy at beginning of age Interval	Prevalence Of ADL Disability	Years lived Without disability		Life expectancy Without ADL disability At beginning Of age interval	Proportion of life expectancy without ADL disability to life expectancy	Life expectancy with ADL disability at beginning of age interval
		In the age Interval	In this and all Subsequent Age Interval			In the age Interval	In this and all subsequent Age Interval			
	l_x	L_x	T_x	e_x		(1 - [5]) [2]		[7] / [1]	[8] / [4] 100	[4] - [8]
				(years)				(years)	(%)	(years)
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**	**[10]**
60-64	71,550	336,321	1,123,567	15.70	0.01170	332,386	1,091,996	15.26	97.21	0.44
65-69	62,979	286,754	787,246	12.50	0.01590	282,195	759,610	12.06	96.49	0.44
70-74	51,723	224,172	500,493	9.68	0.02600	218,344	477,415	9.23	95.35	0.45
75-79	37,946	152,888	276,320	7.28	0.03750	147,155	259,071	6.83	93.78	0.45
80+	23,209	123,433	123,433	5.32	0.09330	111,917	111,917	4.82	90.64	0.50

Table D2 Active life expectancy for female population in Thailand, 2002

Age Interval	Number living at Beginning of age Interval	Years lived		Life Expectancy at beginning Of age Interval	Prevalence Of ADL Disability	Years lived without disability		Life Expectancy Without ADL Disability at beginning of age Interval	Proportion of life expectancy Without ADL Disability To life Expectancy	Life expectancy with ADL disability at beginning of age interval
		In the age interval	In this and all Subsequent Age Interval			In the age Interval	In this and all Subsequent Age Interval			
	l_x	L_x	T_x	e_x		(1 - [5]) [2]		[7] / [1]	[8] / [4] 100	[4] - [8]
				(years)				(years)	(%)	(years)
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**	**[10]**
60-64	87,140	422,033	1,664,711	19.10	0.0156	415,449	1,595,617	18.31	95.87	0.79
65-69	81,673	386,573	1,242,678	15.22	0.0117	382,050	1,180,168	14.45	94.94	0.77
70-74	72,956	331,844	856,105	11.73	0.0294	322,088	798,117	10.94	93.26	0.79
75-79	59,782	254,757	524,261	8.77	0.0427	243,879	476,030	7.96	90.80	0.81
80+	42,121	269,504	269,504	6.40	0.1386	232,151	232,151	5.51	86.12	0.89

Table D3 Active life expectancy for male population in Thailand, 2007

Age Interval	Number living at Beginning of age Interval	Years lived		Life Expectancy At beginning of age Interval	Prevalence Of ADL Disability	Years lived without disability		Life Expectancy Without ADL Disability at beginning of age Interval	Proportion of life expectancy Without ADL Disability to life Expectancy	Life expectancy with ADL disability at beginning of age interval
		In the age Interval	In this and all Subsequent Age Interval			In the age Interval	In this and all subsequent Age Interval			
	l_x	L_x	T_x	e_x		(1 - [5]) [2]		[7] / [1]	[8] / [4] 100	[4] - [8]
				(years)				(years)	(%)	(years)
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**	**[10]**
60-64	75,612	357,068	1,220,681	16.14	0.0163	351,248	1,176,940	15.57	96.44	0.57
65-69	67,216	307,779	863,613	12.85	0.0255	299,931	825,692	12.28	95.60	0.57
70-74	55,896	243,926	555,834	9.94	0.0348	235,437	525,762	9.41	94.63	0.53
75-79	41,674	169,300	311,908	7.48	0.0366	163,104	290,324	6.97	93.14	0.51
80+	26,046	142,608	142,608	5.48	0.1079	127,221	127,221	4.88	89.13	0.60

Table D4 Active life expectancy for the females Population in Thailand, 2007

Age interval	Number living at beginning of age interval l_x **[1]**	Years lived: In the age interval L_x **[2]**	Years lived: In this and all Subsequent Age Interval T_x **[3]**	Life Expectancy At beginning of age Interval e_x (years) **[4]**	Prevalence Of ADL Disability **[5]**	Years lived without disability: In the age Interval (1 - [5]) [2] **[6]**	Years lived without disability: In this and all Subsequent Age Interval **[7]**	Life Expectancy Without ADL disability at beginning of age interval [7] / [1] (years) **[8]**	Proportion of life expectancy Without ADL disability to life expectancy [8] / [4] 100 (%) **[9]**	Life Expectancy With ADL Disability at beginning of age Interval [4] - [8] (years) **[10]**
60-64	88546	430305	1724239	19.47	0.01220	425,055	1,632,888	18.44	94.72	1.03
65-69	83369	396621	1293934	15.52	0.02200	387,895	1,207,832	14.49	93.35	1.03
70-74	74943	343578	897313	11.97	0.03790	330,556	819,937	10.94	91.40	1.03
75-79	61970	265435	553735	8.94	0.05270	251,447	489,381	7.90	88.33	1.04
80+	44204	288300	288300	6.52	0.17470	237,934	237,934	5.38	82.56	1.14

Curriculum Vitae

Name: Ms. Araya Prasertchai

Place of Birth: Pichit

Affiliation and Position:

Nursing Technical Officer,

Bureau of Nursing, Ministry of Public Health

Nonthaburi, Thailand

2005- 2008 Doctoral of Philosophy in Research for Health Development Program (International Program), Graduate School, Chulalongkorn University, Bangkok, Thailand

Master Degree: (Medicine and Social Science) Master of Medicine and Social Science, Faculty of Social Science, Mahidol University, Nakornpratom, Thailand

Bachelor Degree: B.Sc (Science), Bachelor of Science (Nursing and Midwifery), Faculty of Nursing, Mahidol University Bangkok, Thailand

<u>Grants</u>

2005-current Department of Medicine Service, Ministry of Public Health for Ph.D

2008-current 90th Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund) for thesis

2009 Asian Graduate Student Fellowships 2009, Asian Research Institute, National University of Singapore