FACTORS RELATED TO PRIMARY HYPERTENSION IN THE ELDERLY

Pol. Capt. POONRUT LEYATIKUL

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE
(EPIDEMIOLOGY)
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2000

ISBN 974-664-800-4

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Poonrut Leyatikul.
.....
Pol. Capt. Poonrut Leyatikul
Candidate

.....
Assoc.Prof. Prasert Assantachai,
M.D. (Hons), F.R.C.P.(London)
Major-Advisor

.....
Asst.Prof. Wattana B. Watanapa,
M.D. (Hons), Ph.D. (Physiology)
Co-Advisor

.....
Lect. Wichai Techasathit,
M.D., M.P.H. (Epidemiol),
Dip Thai Brd Int Med
Co-Advisor

.....
Prof. Liangchai Limlomwongse,
Ph.D.
Dean
Faculty of Graduate Studies

.....
Prof. Surapol Suwanagool,
M.D., M.P.H., F.A.C.P.
Chairman
Master of Science Programme
in Epidemiology
Faculty of Medicine, Siriraj Hospital

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FACTORS RELATED TO PRIMARY HYPERTENSION IN THE ELDERLY

was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Science (Epidemiology)

on

October 25, 2000

Poonrut Leyatikul.
.....
Pol. Capt. Poonrut Leyatikul
Candidate

Prasert Assantachai
.....
Assoc.Prof.Prasert Assantachai,
M.D. (Hons), F.R.C.P.(London)
Chairman

Wattana B. Watanapa
.....
Asst.Prof. Dr. Wattana B. Watanapa,
M.D. (Hons), Ph.D. (Physiology)
Member

P. Buranakitjaroen
.....
Assoc.Prof. Peera Buranakitjaroen,
M.D., M.Sc. (London),
D.Phil.(Oxford)
Member

Wichai Techasathit
.....
Lect. Wichai Techasathit,
M.D., M.P.H. (Epidemiol),
Dip Thai Brd Int Med
Member

Liangchai Limlomwongse
.....
Prof. Liangchai Limlomwongse,
Ph.D.
Dean
Faculty of Graduate Studies
Mahidol University

P. Sakolsatayadorn
.....
Prof.Piyasakol Sakolsatayadorn,
M.D., F.R.C.S.T.
Dean
Faculty of Medicine, Siriraj Hospital
Mahidol University

ACKNOWLEDGEMENT

I would like to express my deepest appreciation and sincere gratitude to my major advisor, Associate Professor Dr. Prasert Assantachai for his supervision, valuable advice, guidance, encouragement and constructive criticism throughout this study. Without his advice, this work would never be accomplished successfully.

My gratefulness and profound gratitude are also given to my co-advisor, Assistant Professor Dr. Wattana B. Watanapa for her kind help, suggestion and constructive comment throughout this study.

I equally appreciate Lect. Dr. Wichai Techasathit, my co-advisor, for his helpful guidance and support with respect to the statistical analysis of the data. My special gratitude to Associate Professor Dr. Peera Buranakitjaroen for his helpful comments and valuable advice. I am also grateful for the co-operation and patience in answering questions of the elderly.

Finally, my grateful indebtedness goes to my parents, my sister and my friends for their love, understanding, support and encouragement throughout this study.

Pol. Capt. Poonrut Leyatikul

4137185 SIEP/M : MAJOR : EPIDEMIOLOGY; M.Sc. (EPIDEMIOLOGY)
KEY WORD : RISK FACTORS / HYPERTENSION / ELDERLY

POONRUT LEYATIKUL : FACTORS RELATED TO PRIMARY HYPERTENSION IN THE ELDERLY. THESIS ADVISOR : PRASERT ASSANTACHAI, M.D. (Hons), F.R.C.P. (London), WATTANA B. WATANAPA, M.D. (Hons), Ph.D. (Physiology), WICHAI TECHASATHIT, M.D., M.P.H. (Epidemiol), Dip Thai Brd Int Med. 91 p. ISBN 974-664-800-4

A case-control study was conducted in order to determine possible risk factors of primary hypertension in the elderly aged 60 years or older, who were selected from hypertension clinic and outpatient department in the Police General Hospital in Bangkok from August to December 1999. The total number of subjects were 354. There were 177 cases of confirmed diagnosis of hypertension and 177 controls did not have hypertension. Data were analyzed by descriptive statistics, chi-square contingency, univariate analysis and multivariate analysis by multiple logistic regression with 95 percent confidence interval, all of which were done through the SPSS/PC+ application.

There were 103 men (58.2%) and 74 women (41.8%) with a mean age of 68.1 years. Conditional Logistic Regression Analysis was applied to calculate adjusted odd ratios. The significant risk factors were family history of hypertension (OR_{adj}= 4.49, 95% CI = 2.13-9.47, P-Value < 0.001), fatty food consumption(OR_{adj} = 6.04, 95% CI = 2.21-16.49, P-Value <0.001), very salty food intake (OR_{adj} = 4.92, 95% CI = 1.98-12.24, P-Value <0.001), smoking (OR_{adj} = 2.66, 95% CI = 1.25-5.65, P-Value = 0.011), alcohol consumption (OR_{adj} = 2.49, 95% CI = 1.40-6.20, P-Value = 0.004), lack of physical exercise (OR_{adj} = 4.85, 95% CI = 2.23-10.03, P-Value < 0.001), diabetes mellitus (OR_{adj} = 4.62, 95% CI = 1.97-10.82, P-Value < 0.001), cardiovascular disease (OR_{adj} = 2.22, 95% CI = 1.07-4.59, P-Value = 0.032), mental stress (OR_{adj} = 7.29, 95% CI = 2.06-25.82, P-Value = 0.002) and the protective factor was undernutrition (OR_{adj}= 0.19, 95% CI = 0.06-0.59, P-Value = 0.004). These findings show some significant risk factors of hypertension in the population and provide knowledge as a baseline in order to prevent and control hypertension in the elderly.

4137185 SIEP/M : สาขาวิชา : วิทยาการระบาด ; วท.ม. (วิทยาการระบาด)

พูนรัตน์ ลียติกุล : ปัจจัยที่มีความสัมพันธ์กับภาวะความดันโลหิตสูงชนิดไม่ทราบสาเหตุในผู้สูงอายุ (FACTORS RELATED TO PRIMARY HYPERTENSION IN THE LDERLY). คณะกรรมการควบคุมวิทยานิพนธ์ : ประเสริฐ อัสสันตชัย, M.D. (Hons), F.R.C.P. (London), วัฒนา วัฒนาภา, M.D. (Hons), (Physiology), วิชัย เตชะสาธิต, M.D., M.P.H. (Epidemiol), Dip Thai Brd Int Med. 91 หน้า. ISBN 974-664-800-4

การศึกษาชนิด Case-control study นี้มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างปัจจัยพื้นฐานด้านประชากร เศรษฐกิจ และสังคม ปัจจัยด้านพฤติกรรมสุขภาพ ปัจจัยด้านสุขภาพและปัจจัยด้านจิตสังคมกับการเกิดภาวะความดันโลหิตสูงชนิดไม่ทราบสาเหตุในผู้สูงอายุในคลินิคความดันโลหิตสูงและที่แผนกผู้ป่วยนอกของแผนกอายุรกรรม โรงพยาบาลตำรวจ ระหว่างเดือน สิงหาคม พ.ศ. 2542 ถึง ธันวาคม พ.ศ. 2542 กลุ่มตัวอย่างที่ศึกษาคือ ผู้สูงอายุ จำนวน 354 ราย ได้แก่ กลุ่มที่ได้รับการตรวจวินิจฉัยว่ามีภาวะความดันโลหิตสูงชนิดไม่ทราบสาเหตุ จำนวน 177 ราย และกลุ่มเปรียบเทียบคือ ผู้ที่ไม่มีภาวะความดันโลหิตสูง จำนวน 177 ราย วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา การทดสอบค่าไคสแควร์ (Chi-square test) การวิเคราะห์แบบตัวแปรเดี่ยว และวิเคราะห์ตัวแปรเชิงซ้อนโดยการใช้ Multiple logistic regression โดยการคำนวณหาค่าอัตราเสี่ยงสัมพัทธ์และคูนัยสำคัญทางสถิติโดยใช้ ค่าความเชื่อมั่น 95 เปอร์เซ็นต์

ผลการศึกษาพบว่า กลุ่มศึกษาเป็นเพศชายร้อยละ 58.2 และ เพศหญิงร้อยละ 41.8 อายุเฉลี่ย 68.1 ปี เมื่อวิเคราะห์ด้วยตัวแปรเชิงซ้อน (multiple logistic regression) โดยควบคุมอิทธิพลของปัจจัยอื่นๆ พบว่าปัจจัยเสี่ยงที่มีความสัมพันธ์กับการเกิดภาวะความดันโลหิตสูงชนิดไม่ทราบสาเหตุในผู้สูงอายุ คือ ประวัติครอบครัวมีภาวะความดันโลหิตสูง (OR_{adj}= 4.49, 95%CI = 2.13-9.47, P-Value< 0.001), การรับประทานอาหารมัน (OR_{adj}= 6.04, 95%CI = 2.21-16.49, P-Value <0.001), การรับประทานอาหารเค็มจัด (OR_{adj}= 4.92, 95%CI = 1.98-12.24, P-Value < 0.001), การสูบบุหรี่ (OR_{adj}= 2.66, 95%CI = 1.25-5.65, P-Value = 0.011), การดื่มสุรา (OR_{adj}= 2.94, 95%CI = 1.40-6.20, P-Value= 0.004), การไม่ออกกำลังกาย (OR_{adj}= 4.85, 95%CI = 2.34-10.03, P-Value < 0.001), การเจ็บป่วยด้วยโรคเบาหวาน (OR_{adj}= 4.62, 95%CI = 1.97-10.82, P-Value < 0.001), การเจ็บป่วยด้วยโรคหัวใจและหลอดเลือดหัวใจ (OR_{adj}= 2.22, 95%CI = 1.07-4.59, P-Value = 0.032), ความเครียด (OR_{adj}= 7.29, 95%CI = 2.06-25.82, P-Value = 0.002) และ ปัจจัยป้องกันคือ ภาวะโภชนาการพร่อง (OR_{adj}= 0.19, 95%CI = 0.06-0.59, P-Value = 0.004)

ผลการศึกษานี้ให้ความรู้เกี่ยวกับปัจจัยเสี่ยงของการเกิดภาวะความดันโลหิตสูงที่จะทำให้ประชาชนมีความระมัดระวังต่อการได้รับปัจจัยเสี่ยงข้างต้นและสามารถนำไปใช้ในการป้องกันและควบคุมโรคความดันโลหิตสูง

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CHAPTER I

INTRODUCTION

RATIONALE AND BACKGROUND

The result of successful development in public health, medical services and social and economic development has led to an increase in the average age of the population. United Nations statistics showed the number of population aged > 60 years was 200 million in 1950 and it was up to 350 million in 1973. It was expected to be 590 million in 2000 world wide (1).

In Thailand, the percentage of elderly population was 4.6% in 1960, up to 7.36% in 1990 and 8.4% in 1999. The percentage of elderly population in 2020 is expected to be 15.28% (2,3,4). This change has lead Thailand to encounter the condition called ***population aging.***

From United Nations criteria, the aging period will start when the percentage of populations aged > 65 years is more than 7%. Thailand will be in the aging period in the year 1999.

In addition, Thailand has changed progressively from an agricultural country to a newly industrialised country. This change especially in medical services has increased the average life expectancy at birth of males and females from 53 and 58 years in 1965 to 67 and 71 years in 1986, respectively. From the latest data on January 1, 2000, the average life expectancy at birth has now increased to 71.1 and 76.1 years respectively (7).

The reduction in the death rate resulted in the increased average life expectancy of Thai males and females from 53.64 and 58.74 years in 1960 to 62.24 and 66.19 years in 1985 – 1990 and approximately 68.15 and 72.39 years in 2000-2005. This reduction has also increased the average life expectancy in different age groups. According to statistics in 1996, the population at the age group of 60-64 years could live for another 20.29 and 23.89 years for the elderly men and women. In the population at the age group of 80 years or over could live for another 10.90 and 13.60 years for the elderly men and women (8).

The increased ratio of elderly population can cause new economic and social problems which Thailand has never faced before. While in the developed countries have done a lot of research about this matter, Thailand has not studied much about this topic. Because there were other more priority problems to solve such as population control, population expansion, etc, the elderly problems are neglected. Following the research regarding the Thai elderly it was agreed that health and sanitation problems were the major problems of elderly people (9). Because of physical, mental and social changes of the elderly which resulted in declined immunity and well-being, the elderly gets sick easily, takes longer time to full recover and were at higher risk of disability or death. Each month, the rate of sickness from all causes in the elderly was 43.60% (10). A common problem found in elderly is **hypertension** (11) which is an important and complicated condition. About 37% of elderly patient (aged > 65 years) are found to have hypertension (12).

Hypertension is a common chronic illness which can arise from the changed situation in the present society which now has high technology, competition, and needs more ability to cope with change and adaptation. These problems cause

conflicts which can lead to mental stress (13). In addition, there are many studies regarding the causes of hypertension such as nutritional behavior, alcohol drinking, cigarette smoking and lack of exercise (14). Hypertension is a non communicable disease associated with other diseases such as ischemic heart disease, stroke, renal failure, and retinopathy leading to blindness (14). The incidence of primary hypertension in the United States is 15% in American adults, especially in the middle-aged and elderly adults. The incidence will occur more when age increases (15).

The report of Health Status of Thai population by national surveys in 1991 - 1992 by the Thailand Health Research Institute and the report of Health Statistics in 1995 by the Ministry of Public Health are shown in Table 1 and 2 (4).

Table 1 The percentage of hypertensive population aged >15 years classified by age, sex and place of residence.

AGE	urban area		rural area	
	Male	Female	Male	Female
15 - 24	1.8	0.5	0.7	0.3
25 - 34	3.0	2.1	1.4	2.1
35 - 44	6.5	5.6	3.3	3.0
45 - 54	14.8	14.1	3.4	6.8
55 - 64	13.7	16.5	5.7	7.1
65 +	13.6	17.5	11.3	11.0

Source : Report of Thai Population Health Survey by Thailand Health Research Institute (4)

Table 2 Leading causes of death per 100,000 population during the period 1991 – 1995.

Cause of death	1991	1992	1993	1994	1995
Heart Disease	54.7	56.0	58.5	62.5	69.2
Accident and Poisonings	45.6	48.5	52.7	61.5	61.5
Cancer	41.2	43.5	45.0	48.9	50.9
Hypertension	15.9	16.9	16.4	15.7	16.1
Suicide	14.8	15.2	14.7	11.1	13.3

Source : Public Health Statistics in 1995 , Ministry of Public Health (4)

The tables signify that the rate of hypertension increased in accordance with age group. Hypertension is the fourth leading cause of death of the country (4) and it is an important problem for public health.

It is believed that there are many leading causes of primary hypertension such as genetics, stress, obesity, cigarette smoking, alcohol drinking, abnormal renal sodium excretion and hormone metabolism (17). Primary hypertension can not be entirely cured and it does not produce the symptoms in the first place. The symptoms in the later period are still unclear even though the disease and the arterial changes gradually continue. In Western countries, hypertensive people who do not control blood pressure will have a short life expectancy; however, it depends on arterial deterioration. If hypertensive patients, even without very high pressure, are not looked after properly, they would risk to complications of peripheral vessel. Thirty percent of the patients had complications which caused arterial deterioration or atherosclerosis. The target organ was destroyed such as cardiomegaly, heart failure, retinopathy and renal failure(18). In Thailand, central nervous system complications were found in

37.4%(19). The consistent treatment to control blood pressure level is at the heart of protection and reduction of severity from target organ damage. Aims for controlling and protecting from the complications of hypertension are to decrease the death rate and disabilities. The methods are to control systolic blood pressure level to less than 160 mmHg and diastolic blood pressure level to less than 90 mmHg (14) by drug use and changes in the life style regarding nutrition, exercise, stress management, and regular monitoring. Hypertension affects not only the patients but also their families.

From the above information, primary hypertension is one of the main health problems of the country and it is usually found in the elderly. The patients should learn and understand the pathology and control blood pressure to prevent complications of target organ damage. Therefore, the association between the risk factors and hypertension in the elderly was the aim of this study.

There are many previous studies about risk factors related to primary hypertension (see chapter two: Review of Literature). Most studies reported that hypertension was associated with age, sex, nutrition, smoking, alcohol, exercise and some diseases, but only a few studies were concerned with the psychosocial factors in the elderly. Stress is one of the most important risk factors related to primary hypertension in the elderly (20). The study is a case -control study using multiple logistic regression analysis.

General Objective

To study factors associated with primary hypertension in the elderly.

Specific Objectives

To study the extent and direction of factors associated with hypertension in the elderly :

1. Personal & socio - economic factors i.e. age, sex, marital status, occupation, and family income.

2. Life style factors regarding nutritional status, cigarette smoking, alcoholic drinking and exercise .

3. Physical factors regarding the history of diabetes mellitus, the history of heart disease and cardiovascular disease, the history of renal disease, and family history of hypertension.

4. Psychosocial factors i.e. stress.

Hypothesis

1. Personal and socio - economic factors are associated with primary hypertension in the elderly.

2. Life style factors are associated with primary hypertension in the elderly.

3. Physical factors are associated with primary hypertension in the elderly.

4. Psychosocial factors are associated with primary hypertension in the elderly.

Population

All hypertensive patients at the general outpatient clinic and hypertension clinic in the Police General Hospital, Bangkok from 1 August 1999 to 31 December 1999 were recruited.

Criteria for Selection of Case and Control groups

Hypertensive patients were considered by systolic blood pressure ≥160 mmHg. and diastolic blood pressure ≥ 95 mmHg. The blood pressure was measured 3 times in each of the two visits, while they were sitting; each time the patients had been relaxed for 5 -10 minutes (21).

Case: Patients who were diagnosed of primary hypertension, aged 60 years or older.

Control: Control subjects were selected from patients at the general outpatient clinic, aged 60 years or older, who never had hypertension.

Definitions

1. The elderly means an individual who is 60 years or older, both male and female, with good consciousness.

2. Primary hypertension is hypertension without any reversible cause and is measured by systolic blood pressure ≥ 160 mmHg and diastolic blood pressure ≥ 95 mmHg (21).

3. Systolic blood pressure is defined as the measurement of blood pressure when the first Korotkoff sound is heard from a stethoscope placed on the brachial artery.

4. Diastolic blood pressure is defined as the measurement of blood pressure when the fifth Korotkoff sound is heard from a stethoscope on the brachial artery.

5. Body weight is in kilograms and the subjects must wear light clothes, take off shoes, and not carrying any heavy objects.

6. Nutritional Status is assessed by:

Male : body weight (Kg.) / (Demi-span)^2 called Demiquet

Female : body weight (Kg.) / (Demi-span) called Mindex

Demi-span is defined as the length measured from base of middle finger to sternum. The measurement is in meters (22).

Results explanation

Undernutrition is defined as an individual who has either Demiquet or Mindex of less than 1 SD below the mean of the sample population. ($< \bar{X}$-SD)

Normal nutrition is defined as an individual who has either Demiquet or Mindex between 1 SD above and below the mean of the sample population ($\bar{X}$-SD) and ($\bar{X}$+SD).

Overnutrition is defined as an individual who has either Demiquet or Mindex of more than 1SD above the mean of the sample population. ($> \bar{X}$+SD)

7. This study used Survey of behavioral risk factors on major non communicable diseases by Ministry of Public Health for assessing stress in the individual (23). The measurement was considered from the frequency of symptoms that occured when having stress. Stress is divided into two groups:

1. Normal Stress is defined when the score is equal to or less than 1SD above the mean of the sample group.

2. High Stress is defined when the score is more than 1SD above the mean of the sample group.

8. Family income is defined as:

- Fair to rich means income is sufficient for expenses.

- Poor means income is insufficient for expenses.

9. Nutritional habits

- **Fatty food** is defined as food that consists of coconut milk and oil such as curry, omelete, fried fish, Chinese sausage, ham, animal - derived cooking oil and fatty pork.

- **Salty food** is defined as food that consists of salted fish, salted cabbage, salty Chinese soya bean cake and pickle which contains soya sauce and fish sauce.

- **Vegetarian food** is defined as food that consists of vegetable and fruit without fatty food and animal meat.

10. Genetics is defined as the history of hypertension in the family of the interviewee.

11. Physical exercise is defined as exercise more than 2-3 times per week. It should take at least 30 minutes each time.

12. Cigarette smoking is defined as smoking $\geq$1 cigarette per day up until the diagnosis of hypertension (24).

13. Alcohol drinking is defined as drinking alcohol $\geq$ 60 cc.per day up until the diagnosis of hypertension was done (18).

CHAPTER II

REVIEW OF LITERATURE

This research aimed to study factors associated with primary hypertension in the elderly. Current theories and research have been reviewed as follows:

1. The elderly and their changes.
2. Hypertension in the elderly.
3. Theory and research.

The elderly and the age group classification

The elderly refers to an individual who is 60 years or older and it is the major change of life because it changes from middle-aged to old-aged. There are many changes in physical, mental, social and economical aspects. The elderly adult will encounter the problems of organ deterioration, less capability, and atherosclerosis in the blood circulation. Stress from physical and psychosocial change can cause hypertension.

The National Institution on Aging has divided old age into two groups.The first group is "the Young Elderly" meaning the the elderly aged between 60-74 years. The second group is "the Old Elderly" meaning the elderly aged 75 years or more.

Some gerontologists have divided the elderly into 4 periods on the basis of characteristics of psychology and sociology (25,26):

1. The Young-Old (aged between 60-69 years) It is the period of change and crisis in life such as retirement and bereavement. This also includes losing position and job in the society as well as income. The majority of them are healthy but sometimes they need support from others. The educated elderly who know how to adapt themselves and still have abilities nearly the same as young people, will be able to participate in both social and family activities.

2. The Middle Aged-Old (aged between 70-79 years) It is the period when they start to get sick. Friends and family members in the same age group have passed away. The elderly will participate in both social and family activities less than before.

3. The Old-Old (aged between 80-89 years) In this period of life they need more privacy but at the same time require some stimulation of these capabilities suitable to their age. They also need more help from others and like to recall the past experiences and memories.

4. The Very Old-Old (aged between 90-99 years) The elderly in this age usually have health problems. The activities should not involve competition and should have time limits. The activity that is appropriate at this age should be relaxing, satisfying. At this period they like to do things to their satisfaction and to be left in peace.

Changes in the elderly

Changes have occurred because of the reduction of capability due to organs deterioration in old age. There are three categories of changes in the elderly :

1. Physical changes (27)

1. Skin - Tissue and sweat gland are atrophic. Subcutaneous fat is reduced and wrinkles appear clearly.

2. Hair – Hair is lost and it turns white.

3. Eyes –Vision is decreased resulting in long-sightedness. Cataracts are normally a major topic in any discussion of ocular disease in old age.

4. Ears – The auditory nerve is deteriorated leading to deafness.

5. Nose - Sense of smell and differentiation are reduced. The appetite is also decreased.

6. Tongue - Sense of taste is decreased because taste buds are less perceptive.

7. Gastrointestinal System – The stomach secretes less hydrochloric acid and pepsin enzyme, therefore the digestion system is incomplete leading to flatulence and constipation. Malnutrition easily occurs.

8. Skeleton - Changing vitamin D absorption and calcium metabolism cause osteoporosis. Intervertebral discs are damaged which cause kyphosis.

9. Joints are degenerated. Bones are weak. Joint pain is worsened especially when walking.

10. Muscles are weak and atrophic.

11. Lung – There is decreased lung elasticity due to fibrosis.

12. Heart - The elasticity of the aorta decreased. The aorta is widened which can increase the systolic blood pressure slightly in the elderly.

13. Kidneys which produce urine can be degenerated and the capability of filtering is declined.

14. Nervous System – The brain is degenerated leading to memory loss.

15. Endocrine and Hormonal System - Endocrine glands lose weight and are degenerated.

2. Mental changes (26)

Not only the physical changes but also mental changes such as mood, comprehension, memory, intelligence and interest must be considered and studied. The central nervous system function is decreased with aging and neurons are degenerative. Therefore, they affect life style changes in the the elderly. The older adults will be easily confused, and forgetful but this depends on the past experience, education, and social condition that the elderly had been involved. Behaviors of the older adults consist of:

1.Basic thought

Thought in the elderly is nostalgic.

2. Emotional expression

The expressions involve being angry, moody, irritated, and sensitive but in some cases they are depressed.

3. Having their own world

The elderly in this case will withdraw themselves from society. Some of them enter monkhood or become nuns but some would make themselves useful to society by becoming active members of charity groups etc.

4. Environmental interest.

The elderly people will show more interest in their environment but they are only interested in things they are satisfied and mainly depends on their basic emotions.

3. Economic and social changes (26)

Economic and social changes involve their status and role in the family, career and society. The social structure has changed to an industrial society. Therefore, the number of single family has increased which means that the elderly are left on their own. Therefore, they feel lonely and depressed. At present with advanced development in science, modern machines replace people which may in turn reduce their roles in society and careers even though they are still capable. Furthermore, retirement or layoff affects the elderly's income.

Hypertension

At present, medical development has improved; doctors can screen and detect diseases earlier. Elderly people are more aware of their health by going to hospital and have their health frequently checked. Therefore, reports of hypertension have increased.

The WHO expert committee on hypertension has defined the level of blood pressure in adults as follows (21):

Systolic Blood pressure

≤ 140 mmHg.	*Normal blood pressure.*
141 - 159 mmHg.	*Borderline hypertension*
≥ 160 mmHg.	*Hypertension*

Diastolic blood pressure

≤ 90 mmHg.	*Normal blood pressure*
91 - 94 mmHg.	*Borderline hypertension*
≥ 95 mmHg.	*Hypertension*

A sustained blood pressure greater than 140 mmHg systolic and 90 mmHg diastolic or the requirement for antihypertensive medication defines hypertension.

We can diagnose exactly and give treatment when the blood pressure was measured 3 times in each of the two visits, while in sitting position; each time the patients has been relaxed for 5 - 10 minutes (28,29).

Types of hypertension (14)

There are two main types of hypertension .

1. Essential hypertension or primary hypertension

Primary hypertension is found in 90 -95% of all hypertensive patients. (24) Many factors were believed to be the causes of hypertension such as genetics, consuming too much salt, obesity, etc.

The diagnosis of essential hypertension is made whenever the original clinical examination and the routine laboratory evaluation reveal no evidence of any

underlying pathology causing blood pressure elevation. Because of the anatomical, hemodynamic, and humoral changes associated with the aging process, primary hypertension in the older patient is usually characterized by strikingly elevated systolic pressure compared to the diastolic pressure levels. Accordingly, it may be classified either as isolated systolic hypertension, or classic primary hypertension. (30)

2. Secondary hypertension

The causes of secondary hypertension are mostly from renal disease, endocrine disorders, vascular disorders, preeclampsia, and taking contraceptive pills. This kind of hypertension is found in 5-10 % of all hypertensive patients.

Clinical characteristics of the elderly with hypertension (31)

Old age affects the negative changes of the physical systems. When the elderly patients get sick, the symptoms are different from those in younger patients and so are the responses to treatment. This can be summarized as follows:

1. The body's homeostasis is decreased because of the physiological change in old age.

1.1 The epidemiology of hypertension

a. The incidence of hypertension in the elderly is increased because the diameter of blood vessels have been reduced by the arterial changes.

b. The incidence of isolated systolic hypertension has increased in the elderly. Isolated systolic hypertension means systolic blood pressure over 160 mmHg. and diastolic blood pressure less than 95 mmHg. Blood pressure has to be measured 4 times. This kind of hypertension is rarely found in people who are younger than 44 years old. Therefore, it is often found in the elderly. The level of

systolic blood pressure depends on the elasticity of the aorta which is degenerated in old age.

c. The incidence of pseudohypertension in the elderly has increased. There is no clinical evidence of left ventricular hypertrophy as found in true hypertension. The brachial artery has lost its elasticity because old age has caused atherosclerosis. The arm cuff can not compress the brachial artery while blood pressure is being measured, and the Korotkoff sound has changed leading to false recording of high blood pressure.

1.2 Response to the treatment

a. Nonpharmacological treatment

To reduce blood pressure, the limitations of salt intake is more efficient in the elderly than in the younger patients. Because of the change in renal tubule of old age, the kidneys can not reabsorb sodium effectively. Consequently, sodium retention is reduced.

b. Pharmacological treatment

Older patients responds to drugs more than the younger patients. Using inappropriate antihypertensive drugs can endanger the elderly patients. For instance, the delivery of a calcium channel blocker under the patient's tongue can decrease blood pressure rapidly. It can affect the cerebral perfusion which can cause cerebrovascular disorder in the elderly.

2. Atypical sign and symptoms

The result of the physiological changes affect the clinical manifestations in different ways from that seen in young patients. These atypical signs and symptoms of adverse drug reaction could be overlooked.

2.1 The patients fall down when they take an over dose of antihypertensive drugs.

2.2 The patients cannot walk or stand up because of prolonged hypotension. The reason is postural hypotension after taking antihypertensive drugs.

2.3 Confusion and depression can be caused by some antihypertensive drugs. Alphamethyldopa and Reserpine should not be used in elderly patients because they affect the central nervous system.

2.4 Urinary incontinence. The history as such should be asked before starting the diuretics.

3. Co-existing pathology such as diabetes mellitus, hyperuricemia and hyperlipidemia can interfere treatment.

4. Taking many drugs at the same time will increase the side effects. Thus, the treatment of hypertension should focus on nonpharmacological treatment first.

Symptoms (29)

The patients with mild to moderate degree of hypertension may not have any symptoms. The following symptoms may be found by chance

1. Headache

Headache in hypertensive patient is rarely found. The pain is usually at the occipital area in the morning. Nausea and blurred vision are usually found in severe or accelerated hypertensive cases.

2. Migraine

Hypertensive patients suffer from migraine more often than normal people and vice versa.

3. Epistaxis

This symptom is rarely found in patients without previous nasal disease which can be cured by controlling blood pressure.

Complications (14,32)

1. Chronic Heart Failure

Hypertensive patients usually have a shorter life expectancy than people with normal blood pressure. Moreover, the patients who do not receive treatment regularly and who do not control the risk factors of hypertension such as obesity, consuming very salty and fatty food also have a shorter life expectancy. If the disease progression is slow, patients may not have any symptoms. The changes which appear at the later stages are vasoconstriction and changes of myocardium. The myocardium will compensate for this peripheral vasoconstriction by increased pumping leading to cardiac hypertrophy. If the patient is not treated properly, the myocardium will be finally dilated and chronic heart failure occurs at this time. This is perhaps the most important complication to recognize, because it can kill at the first or any subsequent attack. During the attack the patient has cyanosis, pulsus alternans, rapid shallow respirations and signs of pulmonary oedema, with pink frothy sputum in severe cases. An ECG and a chest X-ray are part of the routine examination of every patient whose hypertension is severe enough to merit treatment.

2. Changes of renal function

As hypertension-induced atherosclerosis also involves the renal artery, the failure of kidney function causes uremia. Urea retention is the most poisonous to the body. If uremia is severe, the patient will lose consciousness and die.

3. Changes of brain function

If there is high resistance in the blood vessel in the brain for a long time, the patient may have atherosclerosis, vasoconstriction or hemorrhage and hypertensive encephalopathy. The hypertensive patients may suffer from headache, nausea, vomiting, confusion, depression, convulsion, and unconsciousness. In addition, some may experience hemiparesis.

3.1 Stroke. The sudden and persistent interruption of cerebral function may be due to embolism, thrombosis or haemorrhage. The differential diagnosis of thrombosis and haemorrhage requires computerized tomography. Points in favour of haemorrhage are stiff neck and subarachnoid hemorrhage leading to xanthochromia in the cerebrospinal fluid; headache and vomiting at onset; high arterial pressure; loss of consciousness; and a rapidly fatal course.

3.2 Subarachniod haemorrhage. Subarachniod haemorrhage begins with sudden intense headache which is quickly followed by coma and often with signs of cranial nerve paralysis. Its relationship to hypertension is uncertain. But it seems common sense to reduce arterial pressure in such patients if it is high.

4. Changes in the retina

These may cause impaired vision and finally blindness. Thus, hypertensive patients should have their eyes checked frequently. The fundus oculi should always be carefully inspected in a dark room, if necessary, with the pupil being dilated.

The presence or absence of arterial disease should be noted and its degree of damage. The presence or absence of papilloedema and exudate is the most important finding. The physician should become familiar with arteriosclerotic retinopathy, which occurs in the benign phase, and hypertensive neuroretinopathy that often heralds the onset of the malignant phase.

5. Changes in arterial walls

When the artery has lost its elasticity, it can rupture anywhere. If the aorta ruptures, it can be life-threatening.

Treatment (32)

There are two main treatments of hypertension: nondrug therapy and drug therapy.

a. Nondrug therapy

The effective methods are reducing salty food intake, having adequate exercise, reducing weight, retricting alcohol drinking, relaxation, and cessation of smoking. These methods can apply to every stage of hypertension, but they should be properly modified for each patient. Nondrug therapy is also the first step of treatment for hypertension especially during the first 3 - 6 months.

Reducing body weight Many hypertensive patients can reduce or control their high blood pressure by reducing their weight. Many researchers have found that body weight may interact with blood pressure level. Obese people are more likely to have hypertension than normal people are.

Diet control

As the elderly require less energy during their daily activities, it is necessary to reduce the high calorie food such as carbohydrate and fat. Male elderly should limit their food intake to less than 2,200 kilocalories. Female elderly should limit their food intake to not over 1,600 kilocalories which is enough for the demands of the body. If the elderly have too much fatty food, it will cause obesity, hyperlipidemia and atherosclerosis. It also aggravates hypertension and heart disease which are the main causes of death in the elderly .

Physical exercise is the most important method to reduce blood pressure as well as increase the efficiency of the heart and blood circulation system. If the patients decide to exercise regularly, they should pass a physical exam and be tested for physical endurance by Exercise Stress Test (EST). In some patients, the ideal exercise for controlling blood pressure is not yet known. The methods for increasing the capability of the heart are walking, jogging and cycling. The patient should exercise properly and consistently at least half an hour per day.

Mental adaptation

Although the mental stress from working and unfamiliar environment is not the direct cause of hypertension, it can increase the blood pressure of hypertensive patients. The patients should avoid stress by being calm and peaceful.They should not get angry easily. Gentle exercise and meditation can reduce the blood pressure level.

The patients should avoid risk factors of hypertension i.e. obesity, smoking cigarettes, drinking alcohol, stress and high cholesterol diets. The hypertensive elderly should do as follows :

- Control weight - Individuals who are obese should lose weight by controlling food and exercise.
- Quit smoking - Nicotine stimulates tachycardia and increases blood pressure.
- Quit drinking alcohol.
- Avoid stress.
- Reduce salty food intake.

The patients should follow the instructions of the doctor strictly and go to see the doctor regularly.

Drug therapy

If nondrug therapy does not work satisfactorily or blood pressure is still high, it is necessary to use antihypertensive drugs.

The objective of using antihypertensive drugs is to reduce blood pressure to a normal level without complications.

1. Beginning with a low dose. Blood pressure should be reduced 5 - 10 mmHg. Rigorous blood pressure control in the short term may bring up side effects. The patients may feel tired, exhausted and dizzy because of hypoperfusion of the brain.

Pharmacologic Treatment (33)

When lifestyle modifications fail to decrease blood pressure satisfactorily or when the risk stratification criteria outlined above indicate initiation of pharmacologic treatment, various classes of antihypertensive agents are available. The major classes of antihypertensive medications and general considerations for their use are listed in Table 3.

Table 3 Drugs Used in the Treatment of Hypertension

Drug class	Mechanism of action	Side effects /adverse reaction	Comment
Thiazides and related diuretics Hydrochlorothiazide Chlorthalidone Metolazone Indapamide	Reduce plasma and extracellular fluid and CO initially; long-term peripheral resistance is lowered and CO is normalized	Hypokalemia, hyperuricemia, hypercalcemia, hyperglycemia, hyponatremia, elevated LDL, triglycerides, photosensitivity	Ineffective when serum creatinine > 2.0 Potentiate lithium toxicity Enhance digitalis toxicity Increase warfarin dose
Loop diuratics Bumetanide Ethacrynic acid Furosemide Torsemide	See Thiazides	Hypokalemia, hyperuricemia, hyperglycemia, reversible deafness	Effective when serum creatinine > 2.0 Ethacrynic acid may be used in sulfa or thaizide allergy Do not cause hypercalcemia

Table 3 (continued)

Drug class	Mechanism of action	Side effects /adverse reaction	Comment
Potassium-sparing diuratics Aldosterone antagonist Spironolactone Aldosterone independent Triamterene Amiloride	Weak diuretics which interfere with Na-K, Na-H exchange in distal renal tubule, increaseed potassium reabsorption	Hyperkalemia, gynecomastia (spironolactone), skin rash	Spironolactone is agent of choice in primary aldosteronism Avoid in renal failure Caution when used with - ACE inhibitors
Adrenergic central α_1-agonists Clonidine Guanabenz Guanfacine Methyldopa	Stimulate central α-receptors which inhibit efferent sympathetic activity	Drowsiness, sedation, dry mouth, fatigue, postural dizziness	Rebound hypertension may occur with abrupt withdrawal, especially when used with high-dose β-blocker therapy Avoid use in unreliable patients
Adrenergic inhibitors α-receptor blockers Doxazosin Prazosin Terazosin	Cause vasodilatation by blockade of postsynaptic α_1- receptors	Postural hypotension, syncope (first dose), weakness, palpitation, headche	Reduce voiding symptoms inbenign prostatic hypertrophy Favorable effect on HDL and total cholesterol Used in treating pheochromocytoma

Table 3 (continued)

Drug class	Mechanism of action	Side effects /adverse reaction	Comment
Adrenergic inhibitors peripheral antagonists Reserpine	Block transport of norepinephrine into storage granules in peripheral neurons, reduce sympathetic tone, deplete tissue catecholamines	Depression, nasal congestion, may aggravate peptic ulcer disease by increasing gastric acid secretion	Contraindicated in patient with a previous hostory of depression or peptic ulcer disease Inexpensive
Guanadrel Guanethidine	Promote degranulation of catecholamine storage granules in peripheral nerve ending, inhibit norepinephrine release from storage sites	Postural hypotension, fluid retention, diarrhea, retrograde ejaculation, exercise-induced hypotension	Do not penetrate central nervous system Interactions with ephedrine, tricyclic antidepressants, and antihistamines
Adrenergic inhibitors α/β-blockers Carvedilol Labetalol	Combined effects of α and β blockade lead to a reduction of TPR, with little effect on CO or heart rate α-Blocking properties generally greater than β-blocker effects	Postural hypotension, head "tingling" or scalp paresthesia with labetalol, nausea with high-dose labetalol, β-blockerr side effects	Available as intravenouse preparation for treating hypertensive crisis May interfere with urinary tests for pheochromocytoma Appear to be lipid neutral Carvedilol may be benefit in advanced CHF

Table 3 (continued)

Drug class	Mechanism of action	Side effects /adverse reaction	Comment
Adrenergic inhibitors β-blockers No ISA Atenolol Betaxolol Bisoprolol Metoprolol Nadolol Propranolol Timolol ISA	Non-ISA drugs lower cardiac output, reduce renin release, and decrease central sympathetic outflow ISA drugs do not reduce cardiac output, and cause mild vasodilatation with reduced total peripheral resistance	Bradycardia, bronchospasm, worsening of heart block or CHF, may hypoglycemic symptoms, fatigue, insomnia, vivid dreams, may cause or complicate depression, reduced exercise tolerance	Should not be used in patients with asthma, COPD, uncompensated CHF, or sick sinus syndrome Should not be abruptly withdrawn in patimts with CAD Drug without ISA lowers HDL and raises triglycerides
ACE inhibitors Benazepril Captopril Enalapril Fosinapril Lisinopril Moexipril Perindopril Quinapril Ramipril Trandolapril	Block angiotensin II Formation, promote vasodilation, lower aldosterone secretion, increase bradykinin and vasodilator prostaglandins	Cough, rash, angioneurotic edema, dysgeusia, or taste disturbamce Hyperkalemia, especially with renal impairment Hypotension with high dose and diuretics Nephrotic-rang proteinuria and leukopenia reported with captipril	Contraindication in 2nd and 3rd trimesters of pregnancy Dose reduction and special monitoring may be required in renal insuffciency Preferred agent for treatment of HBP complication CHF or diabetes

Table 3 (continued)

Drug class	Mechanism of action	Side effects /adverse reaction	Comments
Angiotensin II Receptor blockers Losartan Valsartan	Block the AT_1 receptor in blood vessels, with resultant fall in TPR and blood pressure, lowers aldosterone secretion	Hyperkalemia and deterioration of renal function infrequent but may occur in patients with renal impairment Angioedema may occur	No cough Gradual onset of antihypertensive action Losartan increases uric acid excretion Contraindicated in the 2nd and 3rd trimester of pregnancy
Calcium anatagonists Diltiazem Verapamil Dihydropyridines Amlodipine Felodipine Isradipine Nicardipine Nifedipine Nisoldipine	Block inward movement of Ca ions across cellmembranes Smooth muscle relaxation and vasodilation with reduction in TPR and preserved or increased CO	Headache, dizziness, edema, constipation Tachycardia and gingival hyperplasia more common with dihydropyridined	Diltiazem and verpamil reduce sinus rate and may cause heart block Digoxin and carbamazepine levels may be increased with verpamil and diltiazem Cyclosporine levels increased with diltiazem, nicardipine,and verapamil

Table 3 (continued)

Drug class	Mechanism of action	Side effects /adverse reaction	Comment
Direct vasodilators Hydralazine Minoxidil	Direct, primary arteriolar varsodilation	Tachycardia, flushing, headache, fluid retention Lupus-link reaction with hydralazine Hair growth with minoxidil May cause angina pectoris in patients with CAD	Should be used with a diuretic to minimize pseudotolerance and with a β-blocker to prevent tachycardia Hydralazine subject to phenotypically determined metabolism

Abbreviations: ACE angiotensin-converting enzyme
CAD coronary artery disease
CHF congestive heart failure
CO cardiac output
COPD chronic obstructive pulmonary disease
HBP high blood pressure
HDL high-density lipoprotein
ISA intrinsic sympathomimetic activity
LAL low-density lipoprotein
TPR total peripheral resistance

Isolated systolic hypertension (33,34)

Isolated systolic hypertension was ignored for many years, but as clinical studies began to demonstrate an increased cardiovascular risk in systemic hypertension, close attention was given to the elevation of the systolic blood pressure

and diastolic blood pressure. Diastolic and to a greater extent, systolic blood pressure increase with age. After age 65, the increase in systolic blood pressure becomes more prevalent, with 65% to 75% of the cases of hypertension in the elderly being isolated systolic hypertension (systolic blood pressure > 160 mmHg. and diastolic blood pressure < 95 mmHg)(32). The incidence of hypertension and the complication rates vary between sexes and different ethnic groups. Men are at greater risk for developing hypertension until age 55, when a reversal begins; by age 75, the incidence is greater in women. At all ages, however, the complication rate is higher in men.

Result of Treatment

From six studies :

1. Systolic Hypertension in the Elderly Program (SHEP) 1991(35).
2. Treatment of Mild Hypertension in the Elderly Management Committee, from Australia 1981 (36).
3. European Working Party on High Blood Pressure in the Elderly Trial 1985 (EWPHE)(37).
4. Randomized Trial of Treatment of Hypertension in Elderly Patients in Primary Care. Coope and Warrender 1986 (38).
5. Swedish Trial in Old Patients with Hypertension (STOP Hypertension) 1991 (39) .
6. Medical Research Council Working Party (MRC) 1992 (40).

All the above studies found that the treatment of hypertension in the elderly could reduce morbidity and mortality of cerebrovascular disease without increased morbidity and mortality from other causes. These six research studies mostly found that the

treatment of hypertension in the elderly could decrease non-fatal strokes and total non - fatal cardiovascular events. Some reports have claimed that cardiac death and stroke death are also reduced. In addition, five of the six reports showed 17 - 40 % reduction of total cardiovascular events, and 25 - 47 % reduction of combined fatal and non - fatal strokes.

Factors associated with hypertension

Theories and research involved in this study:

1. **Personal & socio-economic factors**

1.1 Genetics

Genetics- Genetics factor have long been assumed to be important in the genesis of hypertension. A family history of elevated blood pressure is one of the strongest risk factors of further development of hypertension in individuals (41).

There are some studies regarding the transmission of hypertension within the family. If a father or a mother has hypertension, children will have a 25% chance to have hypertension. If the parents have hypertension, children will have a chance of 60% (42) to have hypertension. It was also found that (18)

1. The people in the same family will have more or less the same blood pressure level.

2. The blood pressure level of identical twins is more similar than those of fraternal twins.

3. There is no association of blood pressure levels between adopted children and step-parents.

- Coto, et al. (43) studied the children of two schools, aged 10-13 years old in Naples, Italy. It was found that the history of hypertension among the parents is associated with hypertension in children.

- Falkner, et al. (44) studied adults who had normal blood pressure. They had different risk factors of hypertension. It was found that the people who had stress, consumed salty food and had genetic factors had higher systolic and diastolic blood pressure than people who had stress, consumed salty food, but without a genetic factor.

1.2 Age and gender

Gender -Hypertension was found in males more than females, especially in the younger age group. Heart disease and arterial disease are the cause of death among these victims. However, the drug response in males is better than in females. Hypertensive risk factors in females are taking contraceptive pill, pregnancy, and estrogen replacement therapy during menopause (18).

Age – The exact causal mechanisms for development of hypertension in the elderly when compared with young persons remain to be fully determined. Because most cases of systolic diastolic hypertension (SDH) occur around age 55 years, it is unlikely that the pathophysiology of SDH is much different in the elderly than in the middle-aged. Structural change in the large vessels may play a predominant role in the rise of systolic blood pressure levels with age. Both a decrease in connective tissue elasticity and an increase in the prevalence of atherosclerosis may result in an increase in peripheral vascular resistance and aortic impedance with age (45).

- Duangporn Rattanaamornchai (46) studied the life styles of the hypertensive elderly at Angthong province. It was found that the life style in males was better than females significantly. In addition, life style affected health behavior in the hypertensive elderly .

- Wongduen Sirirak (47) surveyed health and sanitation of 100 elderly patients at the outpatient clinic in Nopparatanarajthani Hospital. It was found that 87% of them had chronic diseases. The diseases, which were often found, were hypertension, heart disease, diabetes mellitus and osteoarthritis.

- Jirapa Hongtrakul (48) studied the ability of self care in hypertensive patients. The study found that gender was not associated with this ability.

- Paiboon Sutiyawongpaisal's study (49) found that age is associated with blood pressure. Blood pressure will increase continuously when a person is getting older.

- Maulopaulos, et al. (50) studied 4,097 people at Athens, Greece, The prevalence of hypertension at age group of 60-64, 65-69, 70-74, 75 years or more were 23.8%, 27.6%, 37.1%, 36.5% in males and 30.3%, 43.5%, 47.7%, 50.0% in females. Prevalence of hypertension was approximately the same for men and women and increased noticeably with age. The relationship between age and hypertension is proved even when controlling the weight, cholesterol level and smoking.

- Svetkey, et al. (51) conducted a cross-sectional study in North Carolina. It was found that hypertension was more common among female elderly than male elderly. The black elderly were more likely to suffer from hypertension than the white elderly.

1.3 Nutritional Status

Obesity causes 5-10 times risk of hypertension. If the patients lose weight of about 2-4 kg, blood pressure can be reduced in both obese and normal people. In addition, cholesterol and triglyceride levels in the blood will decrease and the chance of atherosclerosis is also reduced (52). Gaining weight within only 1-2 months aggravates high blood pressure. In hypertensive patients, if they lose weight, the dose of drugs can be reduced or even stopped (53).

- Nibha Charoonvesama. (54) has indicated that obesity and sodium retention were associated with hypertension. The study has found that if body weight is increased by 10 kg., blood pressure will increase 3 mmHg., both systolic and diastolic blood pressure.

- Masaki, et al. (55) studied the relationship between body mass index and hypertension by a cross-sectional design in 1,378 male Japanese Americans aged between 60 - 82 years for 2 years. The study has controlled the physical exercise, alcohol drinking, cigarette smoking and diabetes mellitus. The result showed body mass index was associated with blood pressure levels in both systolic and diastolic blood pressure.

- De Vore (56) found that obesity and overweight were associated with hypertension, diabetes mellitus, heart disease, osteoarthritis, and cancer.

- Kumanyika (57) studied an experimental control trial and found that body weight was associated with blood pressure. Controlling weight can control and prevent hypertension in black Americans. Obesity was the risk factor of heart disease, diabetes mellitus and hyperlipidemia.

1.4 Occupation and income

In the present society, money is essential for life. Having financial problems can affect a person 's life including the elderly and their health behavior. In Thai society, the elderly do not have financial welfare except retired government officers or state enterprise officers. However, these are only the minority of the Thai elderly. The study of the elderly also found that the poverty is the root cause of sickness because they cannot afford the health care expenses.

- Kasal and Cobb (58) compared workers in two factories, one of which was closed. The result showed that the blood pressure level of the workers who would lose their jobs clearly increased. It was higher than those when they just got a new job. Blood pressure of the workers in another factory did not change statistically. Therefore , unemployment can be related to high blood pressure.

- Vasana Puramaneewat (59) compared the life style between hypertensive patients and people with normal blood pressure. The study found that people, who worked as government officers, state enterprise officers and employee in the private company, had different life style which were statistically significant.

- Duangporn Rattanamornchai (46) found that the income of the elderly is related to life style. Those with different incomes got different life styles with statistical significance. The way of life affected physical status of hypertensive the elderly.

2. Life style factors

Vegetarian diet. There is convincing evidence from epidemiological studies and randomized controlled trials that adoption of an ovo-lacto vegetarian diet leads to blood pressure reduction in both normotensive and hypertensive subjects. This effect does not appear to have anything to do with sodium intake and weight loss, but it is an additive effect of weight reduction. Long-term adherence to a vegetarian diet was associated with reduction of blood pressure in the elderly people. But the specific vegetarian nutrients and the mechanisms involved are still unknown (61).

Dietary habit. High sodium intake (salty food usually consists of sodium) was associated with high blood pressure level. Sodium can absorb water and make the arterial wall swollen. It increases volume of the blood and the resistance of the circulation. The degree of rise in blood pressure when the body receives sodium is different in each individual. It was found that the blood pressure of the elderly, hypertensive patients, or diabetic patients increased excessively with the same amount of sodium intake compared to normal people(19,62).

Cigarette smoking. Smoking can be dangerous to patients with myocardial ischemia. A research study found that a man who has diastolic blood pressure $\geq$ 130 mmHg. and smokes 10 or more cigarettes per day increased the risk of cardiovascular death (19). Therefore, patients should quit smoking because it aggravates the complications of hypertension as nicotine causes tachycardia, and high blood pressure.

Physical exercise. Regular exercise is necessary for hypertensive elderly. It encourages the efficiency of heart pumping and increases the free fatty acid metabolism. In addition, it can reduce the cholesterol level in blood and atherosclerosis. Patients also lose weight and relax from stress. Therefore, exercise can decrease the blood pressure level. Aoravee Trokee (52) found that a person who exercised frequently had less chance of having hypertension . Somjit Hanucharoenkul (17) reported that regular physical exercise can prevent and control hypertension.

Alcohol drinking is the main risk factor of hypertension. Aoravee Trokee (52) reported that drinking alcohol of more than 3 glasses per day can increase blood pressure especially in the elderly and hypertensive patients. Another research has confirmed that drinking alcohol of about 2 ounces per day can increase blood pressure by about 1 mmHg (18). Sawet Nontakanun (63) reported that the a person who had high blood pressure usually drink much more alcohol than an average person. It can be said that alcohol aggravates high blood pressure, especially in a person who drinks more than 2 glasses per day.

- Kasem Wattanachai (14) found that the vegetarians had low blood pressure. Mild hypertensive patients who took vegetarian food for 6 weeks could reduce their blood pressure. The study of the relationship between calcium and high blood pressure indicates that hypertensive patients get less calcium in food than the normal blood pressure people.

- Stevens, et al. (64) studied the relationship between body mass index, hyperlipidemia and hypertension in the elderly. In each of the four race and in both gender groups, body mass index was correlated with cholesterol and hypertension.

Body mass index tended to be positively associated with total cholesterol. It is associated with high lipid level in the blood. Four groups of black males and females with an average age of 72.7 years had been monitored. The result of study showed that body mass index and hyperlipidemia are associated with hypertension in the elderly.

- Weir (65) conducted an epidemiologic study in black Americans regarding the relationship between morbidity, mortality and hypertension in the elderly. The study found that hypertension is a risk factor for vascular disorder. It was also hazardous to the organs involved. The prevention of high blood pressure included avoiding risk factors that were obesity, salty food and fatty food.

- Prasert Assantachai, et al.(66) studied hypertension in 335 elderly people in 7 communities in Bangkok. The study found that hypertension in the elderly had unique clinical characteristics, diagnosis, treatment, and complications which were different from the younger patients. The prevalence of hypertension was 36.5%. The study also found that independent associated factors of hypertension in the elderly are the history of hyperlipidemia and hyperuricemia.

- Wichai Tanpaichit (67) found that smoking is the important risk factor of atherosclerosis, hypertension and poor health.

- The World Health Organization (68) indicated that regular alcohol drinking increased the risk of hypertension, cerebrovascular disease, cirrhosis and cancers.

- Motoyama, et al. (69) experimented the result of exercise in hypertensive elderly. The control group took only antihypertensive drugs and the training group was treated by treadmill exercise for 30 minutes 3-6 times per week for 3 months. The

result showed the blood pressure level of the training group was lower than the control group with statistical significance.

- Sleight (70) found the way of preventing coronary heart disease in the elderly with hypertension. Using antihypertensive drug and changing life style such as stopping smoking, exercise and reducing salty and fatty food can do the trick.

3. Associated medical conditions

The cause of primary hypertension is unidentified. It may be associated with multiple factors. Hypertension is usually associated with heart disease, vascular disease, renal disease and diabetes mellitus.

- Weijenberg, et al. (71) did a cohort study to explore the relationship between diastolic blood pressure, systolic blood pressure, and heart disease. The cardiac death of 885 Dutch elderly men was associated with high blood pressure with statistical significance after controlling the age, body mass index, hyperlipidermia, smoking and drinking.

- Kasem Wattanachai (14) found that hypertension was the main factor of coronary heart disease and heart failure in adults.

- Hilo, et al. (72) found that diastolic blood pressure was associated with myocardial dysfunction. It causes left ventricle disorder and enlargement.

- Valentin (73) had studied the epidemiology of cardiovascular disease and stroke. Hypertension was associated with cardiovascular disease and stroke.

- Yi and Black (74) studied hypertension in the elderly and found that hypertension was a risk factor of heart disease and renal disease. The treatment should begin with changing life styles including drug use.

- Tai et al. (75) studied the epidemiology of diabetes mellitus in Taiwan. He monitored 11,478 people in Taipei and other 5 provinces. The results indicated that physical activity, body mass index, age, and hypertension were associated with diabetes mellitus. In the same age group, diabetic patients tended to have hypertension.

- Supachai Tanomsup (76) had indicated that sixty percent of non-insulin-dependent diabetes mellitus (NIDDM) patients had hypertension. Diabetes mellitus and hypertension were mostly found in the elderly. These diseases would lead to atherosclerosis.

4. Psychosocial Factor (Stress)

Stress can affect the circulatory system. It can increase the resistance of blood vessels and cardiac output by stimulating the sympathetic nervous system. This causes high blood pressure (18). Emotional stress can increase blood pressure immediately (60). Stress can be reduced by exercise, meditation and relaxation. Which will be effective when the patients pratice consistently over a considerable period of time (52).

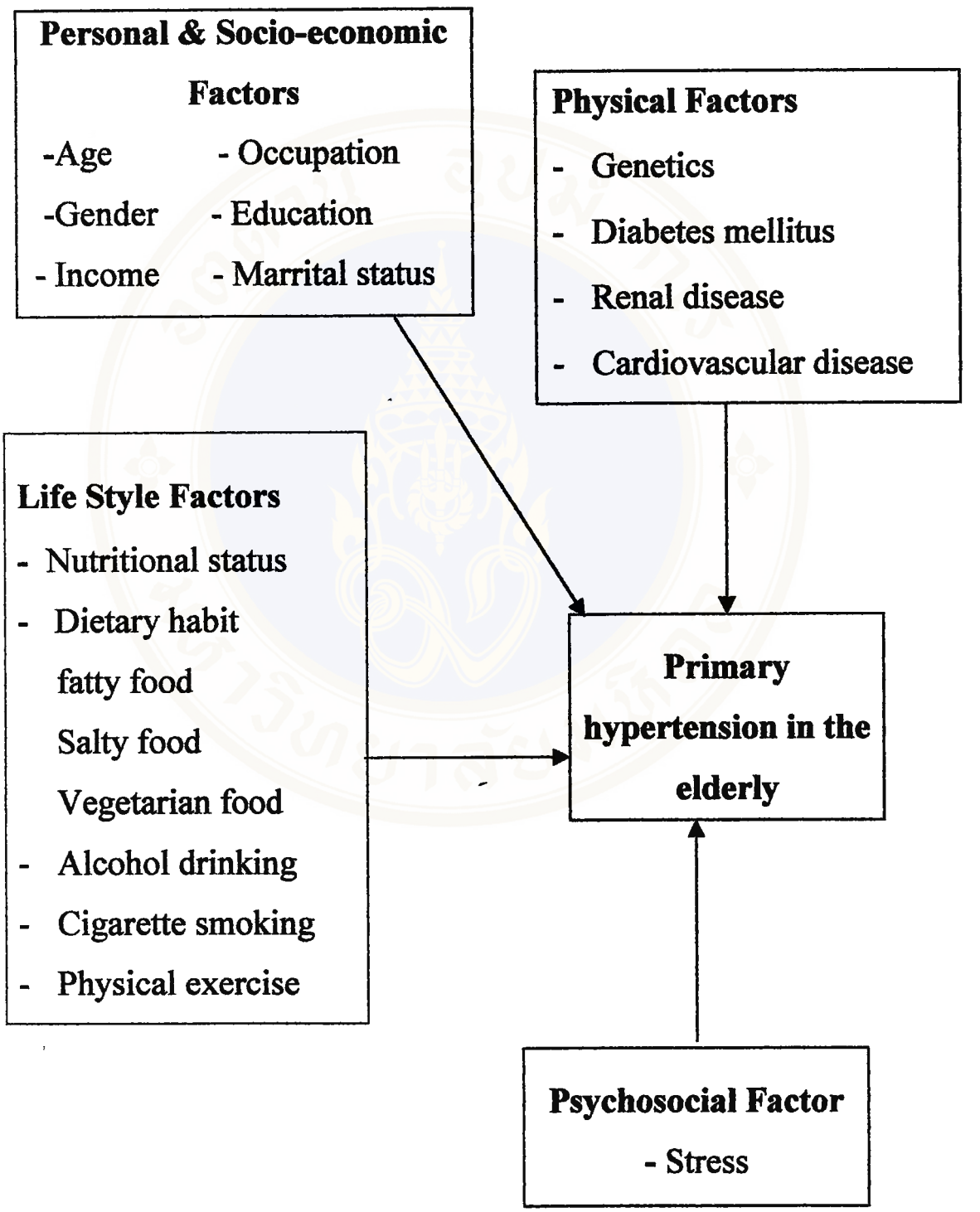
- Krieger (77) found that stress and anger are important risk factors of hypertension. A person who is under pressure and stress, has 4.4 times higher risk to suffer from hypertension than those who do not have stress or anger..

- Theorell (20) has studied the relationship of blood pressure levels and stress when working in a noisy place. This study tracked for 9 months a sample group of 51 males and 22 females. The study found that a person who had stress from

working hard usually had history of hypertension in the family. Stress aggravates the changes of cortisol, prolactin and testosterone levels.

- Pickering and Gerin (78) studied the relationship of stress and blood pressure levels by recording blood pressure continuously. The study found that stress during daily life could cause high blood pressure level.

Conceptual Framework



CHAPTER III

MATERIAL AND METHODS

Study design This study is designed as a case - control study.

Target population

The sample population were patients at the general outpatient clinic aged 60 years or older in the Police General Hospital. The patients were divided into two groups:

1.Case: Patients aged $\geq$ 60 years who were treated at the outpatient department (OPD) in the Police General Hospital (in hypertension clinic and geriatric clinic). They were diagnosed with hypertension by a doctor.

The sample population in this study were hypertensive patient who were treated in hypertension clinic. In this clinic, patients must have blood pressure equal to or more than 160 / 95 mmHg, and are have been treated with antihypertensive drugs by specialist. So, all patients in this study had blood pressure level equal to or more than 160 / 95 mmHg.

2.Control: A group of patients aged 60 years or older who were followed up at the OPD in the Police General Hospital. They had other diseases except hypertension, i.e., their systolic blood pressure were less than 140 mmHg and diastolic blood pressure were less than 90 mmHg.

Inclusion criteria

1. Patients aged 60 years or older when data were collected.
2. Hypertensive patients who must be checked and diagnosed by physicians.
3. Patients who agree to answer the questionnaire.

Sample population

This study was based on a case-control study with the ratio of case to control population being 1:1

Calculations (76)

$$n = \frac{\left[Z_{\alpha/2}\sqrt{2P(1-P)} + Z_{\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)}\right]^2}{(P_1-P_2)^2}$$

n = sample size of each group.

P_1 = proportion of poor complication to medication more than once a week (26%) in controllable group.

OR = 2.09

P_2 = $(P_1 \times OR)/1 + P_1(OR-1)$

P_2 = $(0.26 \times 2.09)/1 + 0.26(2.09-1)$ = 0.42

P = $(P_1+P_2)/2$ = $(0.26+0.42)/2$ = 0.34

Confidence level = 95%

Test ability = 80%

$Z_{\alpha/2}$ = Standard normal deviate in two tailed test with alpha = 0.05

= 1.96

Z_β = Standard normal deviate when power of the test is equal to 80 % (β=0.20)

= 0.84

$$n = \frac{\left[1.96\sqrt{2(0.34)(1-0.34)} + 0.84\sqrt{0.26(1-0.26)+0.42(1-0.42)}\right]^2}{(0.26-0.42)^2}$$

n = 147

Therefore, the calculated number of the sample group is 147 cases in each group. It was also increased 20% to 177 cases in each group. The total population was 354 cases.

In this study, the sample population was calculated based on the review of literature and also based on Nantaya Kaewrattanapattama's study in Siriraj Hospital whose study showed environmental and psychosocial factors were associated with hypertension. The number of elderly adults in the latter was seventy-five percent. The highest number of the sample group from calculation is the target amount of this study (80).

Factors	P_1	OR	n
Obesity	0.11	5.09	6
History of heart disease	0.40	38.92	133
Genetics	0.26	2.09	147
Salty consumption behavior	0.26	2.06	136

Materials

1. Questionnaire verified by Dr. Prasert Assantachai (major advisor) which consisted of 4 parts:

1.1 Personal and socio - economic data.

1.2 Life style data.

1.3 Physical data

1.4 Psychosocial data

2. Measuring tape to measure demi-span.

3. Weighing scale

Data collection

Thirty sets of questionnaires were pretested in Police General Hospital for comprehensibility. The pretest questionnaires were reviewed before using in the study. The same questionnaires were used for both the cases and the control. All questionnaires were filled by only one interviewer, i.e. the auther.

Variables

1.Independent variables

1.1 Personal and socio - economic factors

- Age
- Gender
- Education
- Marital status
- Financial status

- Occupation

1.2 Life style data

- Nutritional status
- Dietary habit

  Fatty food, salty food and vegetarian food
- Cigarette smoking
- Alcohol drinking
- Physical exercise

1.3 Associated medical conditions

- Family history of hypertension
- Diabetes mellitus
- Cardiovascular disease
- Renal disease

1.4 Psychosocial factor

- Stress

2. Dependent variable is having or not having primary hypertension.

Psychosocial Data

The form of Survey of behavioral risk factors on major non communicable diseases by Ministry of Public Health was used. It consists of 20 questions about symptoms and feelings when the patients experience stress (see Appendix).

The questions include positive questions (question 18,19) and negative ones (question 2-20, except 18,19). The scoring are as follow:

Question 1 Points for the answer of :

Yes	3 points
No	1 point

Question 18,19 Points for the answer of:

Never	3 points
Seldom	2 points
Always	1 point

Question 2-20 (except 18,19) Points for the answer of:

Never	1 point
Seldom	2 points
Always	3 points

The analysis of Survey of behavioral risk factors on major non communicable diseases can be done by counting the points of 20 questions. The lowest point is 20 and the highest point is 60.

Content Validity - The content of the questionnaire was checked by Dr. Prasert Assantachai, the thesis advisor, in order to fulfil the objectives of the study.

Questionnaire Test - The questionnaire was tested in thirty hypertensive patients at the hypertensive clinic and at the OPD in the Police General Hospital in order to check the language used in the questionnaire.

The reliability of the questionnaire was 0.9149 as calculated by Conbach's alpha method (SPSS/PC).

Statistics

The data analysis was performed on microcomputer using SPSS/PC program. Association was considered statistically significant if two tailed P-value < 0.05.

- Descriptive analysis was shown by frequency, percentage, mean and standard deviation.
- Analytic study

1. **Univariate analysis** - Odds ratio, 95% confidence interval and P-value from Pearson's chi-square were used to compare each of the independent risk factors. This analysis is for testing size and direction of the relationship between factors and hypertension in the elderly.

2. **Multivariate analysis** The study cannot show the relationship because confounders cannot be controlled. Therefore, this study tried to reduce the confounders by using multiple logistic regression and controlling all confounders.

CHAPTER IV

RESULTS

Data were collected from Police General Hospital. Total numbers of the elderly selected as eligible participating subjects in this study were 354. There were 177 cases and 177 controls.

The studied results were presented as follow:

1.General and socio-demographic characteristics

2.Comparison of characteristics of variables which are associated with hypertension in the elderly between case and control (Univariate Analysis)

3.Comparison of characteristics of variables which are associated with hypertension in the elderly by controlling other confounders (Multiple Logistic Regression Analysis)

1. **General and socio-demographic characteristics** (Table 4)

The comparisons of various socio–demographic characteristics between cases and controls by calculating percentage, mean, and standard deviation.

1.1 Personal and Socio-economic Factors

Sex: Cases and controls in general were not different. The majority of cases and controls were male (58.2% and 56.5%).

Age: The majority of cases and controls were in 60-69 years age-group (62.1% and 68.9%). The minority of cases and controls were 70-79 years age-group

(32.2% and 22.6%). The mean age of cases was 68.07 years (SD=6.08). The mean age of controls was 67.63 years (SD=6.57).

Marital Status: The largest group of cases and controls were married (81.9% and 76.3%). Smaller groups were widowed and divorced or separated (16.9% and 19.8%).

Occupation: Most of the cases and controls were government officer (40.7% and 41.8%). The smaller group of cases and controls was businessman (21.5% and 22.6% respectively). State-enterprise officers was the smallest group (2.3% and 0.6%).

Education: Most cases and controls completed primary school (29.4% and 31.1% respectively). The smaller group of cases achieved secondary school (20.3%) while controls were graduates from vocational schools (23.7%).

Family Income: The majority of cases and controls had sufficient income (69.5% and 77.4% respectively). Fewer had some savings (27.7% and 18.1% respectively). The smallest group had insufficient income (2.8% and 4.5% respectively).

Member in the family: Most of cases and controls had 2 persons or more in the family (73.4% and 81.4% respectively). Those who lived alone in the cases and controls were 1.2% and 0 % respectively.

Table 4 Comparison of socio-demographic characteristics between cases and controls

Characteristic	Cases (177)		Controls (177)	
	Number	%	Number	%
• **Sex**				
Female	74	41.8	77	43.5
Male	103	58.2	100	56.5
• **Age**				
60-69	110	62.1	122	68.9
70-79	57	32.2	40	22.6
80+	10	5.6	15	8.5
Mean ±(SD)	68.07 ± 6.08		67.63 ± 6.57	
• **Marital status**				
Single	2	1.1	7	4.0
Married	145	81.9	135	76.3
Separated (widowed /divorced)	30	16.9	35	19.8
• **Family income**				
Insufficient	5	2.8	8	4.5
Sufficient	123	69.5	137	77.4
Some savings	49	27.7	32	18.1

Table 4 (continued)

Characteristic	Cases (177) Number	%	Controls (177) Number	%
• **Occupation**				
Unemployed	34	19.2	31	17.5
Business	38	21.5	40	22.6
Labor	14	7.9	10	5.6
Employee	10	5.6	11	6.2
Farmer	5	2.8	10	5.6
Retired government officer	72	40.7	74	41.8
Retired state enterprise officer	4	2.3	1	0.6
• **Education**				
No formal education	25	14.1	12	6.8
Primary school	52	29.4	55	31.1
Secondary school	36	20.3	37	20.9
Vocational education	35	19.8	42	23.7
Bachelor degree or higher	29	16.4	31	17.5
• **Member in the family**				
0	2	1.2	0	0
1	45	25.4	33	18.6
2+	130	73.4	144	81.4

2. **The relationship between factors and causes of primary hypertension in the elderly**

Univariate analysis was done to determine the risk factors of primary hypertension in the elderly . Those factors are as follow:

2.1 Nutritional Status: (Table 5)

Mean of Demiquet = 90.10, SD = 9.78.

Mean of Mindex = 75.17, SD = 10.19

• Undernutrition was calculated by the formula $< \bar{X} - SD$.

The cut-off point of undernutrition of male and female was < 80.32, < 64.97 respectively.

• Normal nutrition was calculated by the formula $(\bar{X} - SD) - (\bar{X} + SD)$

Normal nutrition of male was shown as 80.32 - 99.88, normal nutrition of female was shown as 64.98 - 85.36.

• Overnutrition was calculated by the formula $> \bar{X} + SD$.

The cut-off point of overnutrition of male and female was s >99.88 and > 85.37 respectively.

Nutritional Status: Normal nutrition, overnutrition, and undernutrition in cases were 73.4%, 22%, and 4.5%. Normal nutrition, overnutrition, and undernutrition in controls were 70.6%, 7.3%, and 22% respectively. Nutritional status were significantly associated with primary hypertension in elderly (P-value <0.001) The risk of hypertension in the elderly who had undernutrition was significantly less than those who had normal nutrition. Undernutrition group had the odds ratio of 0.19 (95%CI=0.08-0.43). Overnutrition was significantly association with hypertension in

the elderly, it was found that overnutrition significantly increased the risk of hypertension (OR= 2.88, 95%CI=1.47-5.65, P-value < 0.002).

Table 5 Association between primary hypertension in the elderly and nutritional status by univariate analysis

Nutritional status	Cases (177) Number	%	Controls (177) Number	%	OR	95% CI	P-value
Normal nutrition*	130	73.4	125	70.6	1	-	-
Undernutrition	8	4.5	39	22.0	0.19	0.08-0.43	<0.001
Overnutrition	39	22.0	13	7.3	2.88	1.47-5.65	<0.002

* Reference group

P-value from Chi-square

2.2 Life Style Factors (Table 6,7)

Frequency of consuming fatty food: Data were categorized as never (49.2% of cases and 83.1% of controls), once a week (23.7% of cases and 13.8% of controls), 2-3 day / week (19.8% of cases and 2.8% of controls), everyday (7.3% of cases and 1.1% of controls). Having fatty food once a week associates with primary hypertension in the elderly with the odds ratio of 3.08 (OR= 3.08, 95% CI= 1.74-5.47, P-value < 0.001). Having fatty food 2-3 day in a week associates with primary hypertension in the elderly with the odds ratio of 11.81 (OR= 11.81, 95% CI= 4.46-31.26,

P-value < 0.001). Having fatty food everyday associates with primary hypertension in the elderly with the odds ratio of 10.97(OR= 10.97, 95% CI= 2.42-49.75, P-value < 0.001).

Frequency of consuming salty food: Data were categorized as never (32.2% of cases and 74.6% of controls), once a week (35.6% of cases and 19.2% of controls), 2-3 day / week (27.1% of cases and 6.2% of controls), everyday (5.1% of cases and 0% of controls). Having salty food once a week associates with primary hypertension in the elderly with the odds ratio of 4.29 (OR= 4.29, 95% CI= 2.55-7.22, P-value < 0.001). Having salty food 2-3 day in a week associates with primary hypertension in the elderly with the odds ratio of 10.11 (OR= 10.11, 95% CI= 4.89-20.87, P-value < 0.001). Consuming everyday cannot be analyzed because nobody of one the controls consumed salty food everyday.

Frequency of consuming vegetarian food: Data were categorized as never (81.9% of cases and 74.6% of controls), once a week (9.0% of cases and 5.1% of controls), 2-3 day / week (3.4% of cases and 2.3% of controls), everyday (5.6% of cases and 18.1% of controls). Having vegetarian food once a week associates with primary hypertension in the elderly with the odds ratio of 1.62 (OR= 1.62, 95% CI= 0.69-3.78, P-value < 0.267). Having vegetarian food 2-3 day in a week associates with primary hypertension in the elderly with the odds ratio of 1.36 (OR= 1.36, 95% CI= 0.37-4.94, P-value < 0.635). Having vegetarian food everyday associates with primary

hypertension in the elderly with the odds ratio of 0.28 (OR= 0.28, 95% CI = 0.13-0.60, P-value < 0.001)

Table 6 Association between primary hypertension in the elderly and consuming behavior by univariate analysis

	Cases (177)		Controls (177)		OR	95% CI	P-value
Food consuming	**n**	**%**	**n**	**%**			
• Having fatty food							
Never*	87	49.2	147	83.1	1	-	-
Once a week	42	23.7	23	13.8	3.08	1.74-5.47	<0.001
2-3day/week	35	19.8	5	2.8	11.81	4.46-31.26	<0.001
Everyday	13	7.3	2	1.1	10.97	2.42-49.75	<0.001
• Having salty food							
Never*	57	32.2	132	74.6	1	-	-
Once a week	63	35.6	34	19.2	4.29	2.55-7.22	<0.001
2-3day/week	48	27.1	11	6.2	10.11	4.9-20.9	<0.001
Everyday	9	5.1	0	0	-	-	-
• Having Vegetarian food							
Never*	145	81.9	132	74.6	1	-	-
Once a week	16	9.0	9	5.1	1.62	0.69-3.78	0.267
2-3day/week	6	3.4	4	2.3	1.36	0.37-4.94	0.635
Everyday	10	5:6	32	18.1	0.28	0.13-0.60	<0.001

* Reference group

P-value from Chi-square

Smoking behavior: Smoking behavior in the case group was more than in the control group (75.1% V.S 32.8%). Likewise, the number of non-smoking in the control group was more than in the case group (67.2% V.S 24.9%). The odds ratio of the smoking behavior among the case group was 6.20 (95%CI = 3.90-9.86, P-value < 0.001).

Drinking behavior: Drinking behavior in the case group was more than in the control group (65.5% V.S 28.2%). Likewise, the number of non-drinking in the control group was more than in the case group (71.8% V.S 34.5%). The odds ratio of the drinking behavior among the case group was 4.83 (95%CI = 3.08-7.58, P-value < 0.001).

Exercise behavior: Non-exercise behavior in the case group was more than in the control group (72.3% V.S 46.3%). Likewise, the number of exercise in the control group was more than in the case group (53.7 % V.S 27.7%). The odds ratio of the non-exercise behavior among the case group was 3.02 (95%CI = 1.94-4.71, P-value < 0.001).

Table 7 Association between primary hypertension in the elderly and behavior of Smoking, Drinking and Physical exercise by univariate analysis

Behavior	Cases (177)		Controls (177)		OR	95% CI	P-value
	n	%	n	%			
• Smoking behavior							
Non- smoking*	44	24.9	119	67.2	1	-	-
Smoking**	133	75.1	58	32.8	6.20	3.90-9.86	<0.001
• Drinking behavior							
Non- drinking*	61	34.5	127	71.8	1	-	-
Drinking***	116	65.5	50	28.2	4.83	3.08-7.58	<0.001
• Physical exercise							
Exercise*	49	27.7	95	53.7	1	-	-
Non-exercise	128	72.3	82	46.3	3.02	1.94-4.71	<0.001

*Reference group

P-value from Chi-square

** Cigarette smoking is defined as smoking ≥1 cigarette per day up until the diagnosis of hypertension.

*** Alcohol drinking is defined as drinking alcohol ≥ 60 cc. per day up until the diagnosis of hypertension.

2.3 Physical Factors (Table 8)

Family history of hypertension: Hypertension background in the case group was more than in the control group (55.4% V.S 13.0%). The odds ratio of having history of hypertenssion among the case group was 8.30 (95%CI=4.89-14.09, P-value< 0.001).

History of Diabetes Mellitus: History of diabetes mellitus in the case group was more than in the control group (32.2% V.S 9.0%). The odds ratio of having history of diabetes mellitus among the case group was 4.78 (95%CI=2.61-8.73, P-value <0.001).

History of Cardiovascular Disease: History of cardiovascular disease in the case group was more than in the control group (63.3% V.S 30.5%). The odds ratio of having history of cardiovascular disease among the case group was 3.92 (95%CI=2.52-6.10, P-value <0.001).

History of Renal Disease: History of Renal Disease in the case group was more than in the control group (9.0% V.S 4.5%). The odds ratio of having history of cardiovascular disease among the case group was 2.10 (95%CI=0.87-5.04, P-value = 0.097).

Table 8 Association between primary hypertension in the elderly and health status by univariate analysis

	Cases (177)		Controls (177)		OR	95% CI	P-value
Health status	**n**	**%**	**n**	**%**			
• **History of hypertension in family**							
No*	79	44.6	154	87.0	1	-	-
Yes	98	55.4	23	13.0	8.30	4.89-14.09	<0.001
• **Diabetes mellitus**							
No*	120	67.8	161	91.0	1	-	-
Yes	57	32.2	16	9.0	4.78	2.61-8.73	<0.001
• **Cardiovascular diseases**							
No*	65	36.7	123	69.5	1	-	-
Yes	112	63.3	54	30.5	3.92	2.52-6.10	<0.001
• **Renal disease**							
No*	161	91.0	169	95.5	1	-	-
Yes	16	9.0	8	4.5	2.1	0.87-5.04	0.097

*Reference group

P-value from Chi-square

2.4 Psychosocial Factor (Table 9)

Stress: Most cases and controls had normal stress level (68.9% and 97.7%).High stress in cases and controls were 31.1% and 2.3% respectively. The mean of stress in both case and control was 34.5 and standard deviation was 7.6. The odds ratio of high stress group, when compared to normal stress group, was significantly associated with primary hypertension in elderly (P-value < 0.001). The odds ratio was 19.49 (95%CI=6.88-55.20).

Table 9 Association between primary hypertension in the elderly and psychosocial status by univariate analysis

	Cases (177)		**Controls (177)**		**OR**	**95% CI**	**P-value**
Characteristic	**n**	**%**	**n**	**%**			
• **Stress**							
Normal* (≤ 42.1)	122	68.9	173	97.7	1	-	-
High (>42.1)	55	31.1	4	2.3	19.49	6.88-55.20	<0.001
Score of stress							
Mean± SD	34.5±7.6						

*Reference group

P-value from Chi-square

3. Multivariate Analysis (Table 10)

Univariate analysis does not take into account the influence of confounding factors which may affect the relationship between factors and cause of hypertension in the elderly. This problem can be solved by *multiple logistic regression* analysis. The factors used in the multivariate analysis were the ones which were significantly associated with hypertension in the elderly in the univariate analysis. These were undernutrition, overnutrition, genetics, consuming fatty food, consuming salty food, consuming vegetarian food, smoking, drinking, exercise, history of diabetes mellitus, history of heart and cardiovascular disease, and stress. However, in some factors, two categories had to be combined because of low numbers in individual categories. These factors were: Having fatty food, Having salty food and Having vegetarian food (see footnote of table 10 on p. 66).

Result of multivariate analysis

As shown in table10, ten risk factors significantly associated with hypertension in the elderly.

Table 10 Association between risk factors and primary hypertension in the elderly before and after adjusting for the effect of variables simultaneously.

Variable	Case		Control		OR_{adj}	95%CI	P-value
	n	%	n	%			
• **Nutritional status**							
Normal nutrition	130	73.4	125	70.6	1	-	-
Undernutrition	8	4.5	39	22.0	0.19	0.06-0.59	0.004*
Overnutrition	39	22.0	13	7.3	1.25	0.45-3.44	0.667
• **Family history of Hypertension**							
No	79	44.6	154	87.0	1	-	-
Yes	98	55.4	23	13.0	4.49	2.13-9.47	< 0.001*
• **Having fatty food[A]**							
No	129	72.9	170	96.0	1	-	-
Yes	48	27.1	7	4.0	6.04	2.21-16.49	< 0.001*
• **Having salty food[B]**							
No	120	67.8	166	93.8	1	-	-
Yes	57	32.2	11	6.2	4.92	1.98-12.24	< 0.001*
• **Having vegetarian food[C]**							
Yes	161	91.0	141	79.7	1	-	-
No	16	9.0	36	20.3	1.13	0.43-2.99	0.806

Table 10 (continued)

Variable	Case		Control		OR_{adj}	95%CI	P-value
	n	%	n	%			
• **Smoking habit**							
Non-smoking	44	24.9	119	67.2	1	-	-
Smoking	133	75.1	58	32.8	2.66	1.25-5.65	0.011*
• **Drinking habit**							
Non-drinking	61	34.5	127	71.8	1	-	-
Drinking	116	65.5	50	28.2	2.94	1.40-6.20	0.004*
• **Physical exercise**							
Yes	49	27.7	95	53.7	1	-	-
No	128	72.3	82	46.3	4.85	2.34-10.03	< 0.001*
• **Diabetes mellitus**							
No	120	67.8	131	91.0	1	-	-
Yes	57	32.2	16	9.0	4.62	1.97-10.82	< 0.001*
• **Cardiovascular disease**							
No	65	36.7	123	69.5	1	-	-
Yes	112	63.3	54	30.5	2.22	1.07-4.59	0.032*
• **Stress**							
Normal	122	68.9	173	97.7	1	-	-
High	55	31.1	4	2.3	7.29	2.06-25.82	0.002*

P-value from Wald test after muliple logistic regression used

A No = never having fatty food or having fatty food once a week.

Yes = having fatty food 2-3 days or everyday a week.

B No = never having salty food or having salty food once a week.

Yes = having salty food 2-3 days or everyday a week.

C No = never having vegetarian food or having vegetarian food once a week.

Yes = having vegetarian food 2-3 days or everyday a week.

CHAPTER V

DISCUSSION

- **Nutritional Status** The risk of hypertension in the elderly who were under nutrition was significantly less than those who were normal nutrition (OR= 0.19, 95% CI = 0.06-0.59, P-value = 0.004). This finding corresponded with the studies of Nibha Charoonvesama (54), Masaki et al. (55), Devore (56) and Kumanyika (57). They reported that hypertensive patients were usually overweight. However this study showed that overnutrition did not significantly relate to hypertension (OR=1.25, 95% CI = 0.45-3.44, P-value = 0.667). The reason behind this unusual finding was due to the contamination of the elderly who was obese in control group and also suffered from other diseases as well.

- **Consuming fatty and salty food everyday** Consuming fatty food everyday significantly associated with hypertension in the elderly (OR= 6.04, 95% CI = 2.21-16.49, P-value < 0.001). Consuming salty food everyday also significantly associated with hypertension in the elderly (OR= 4.92, 95% CI = 1.98-12.24, P-value < 0.001). The findings agree with the study of Stevens et al. (64), Weir (65), and Sleight (70). The results of previous study supported the relationship between body mass index, hyperlipidemia and hypertension in the elderly. Body mass index correlated with cholesterol and hypertension. The prevention of high blood pressure therefore included avoiding risk factors such as obesity, salty food and fatty food.

In this study, having vegetarian food everyday was found to be an inverse association with hypertension (OR = 0.28, 95% CI = 0.13-0.60, P-value < 0.001). From stratified analysis test, it was found that consuming fatty and salty food had effect on consuming vegetarian food but after adjusting for the effects of other variable, consuming vegetarian was not a significant independent risk factor (OR= 1.13, 95% CI = 0.43-2.99, P-value = 0.806). In contrast, other authors also reported that vegetarian diet was associated with reduction of blood pressure in the elderly people. But the specific vegetarian nutrients which bear this effect cannot clearly be identified and the mechanisms involved are still unknown (14,61).

- **Exercise** This study found that no exercise or exercise only once a week significantly associated with hypertension in the elderly (OR = 4.85, 95% CI = 2.34-10.03, P-value < 0.001). According to the study of Motoyama (69), exercise 30 minutes/time and 3-6 times/week can reduce blood pressure and the cholesterol level in blood. The patients also lose weight and relax from stress. Therefore, exercise can decrease the blood pressure level. Aoravee Trokee (52) found that a person who exercised frequently had less chance of having hypertension. Somjit Hanucharoenkul (18) reported that regular physical exercise can prevent and control hypertension.

- **Genetics** The risk of hypertension in the elderly who had history of hypertension in family was significantly higher than those who had no history of hypertension in family (OR = 4.49, 95% CI = 2.13-9.47, P-value < 0.001). The result agreed with the study of Coto et al (43). The history of hypertension among the parents associated with hypertension among their children. Falkner et al (44) found

that the people who had stress, consumed salty food and had genetic factors had higher systolic and diastolic blood pressure than people who had the same stress, consumed salty food, but without a genetic factor.

- **History of chronic illness** The result showed that history of diabetes mellitus significantly associated with hypertension in the elderly (OR= 4.62, 95% CI = 1.97-10.82, P-value < 0.001) and history of cardiovascular disease also significantly associated with hypertension in the elderly (OR= 2.22, 95% CI = 1.07-4.59, P-value = 0.032). The result agreed with the study of Weijenberg et al. (71), Hilo et al. (72), Valentin (73), and Yi and Black (74) who had found that hypertension related to cardiovascular disease and heart failure. Tri et al. (75) found that diabetic patients were at risk of hypertension. Supachai Thanomsap reported that about sixty percents of diabetic patients had hypertension. In univariate analysis, history of renal disease did not associate with hypertension in the elderly (P-value = 0.097) and thus did not support the hypothesis. This may be explained by the presence of stone in urinary system up to 4 out 8 cases of the control group.

- **Stress** This result from univariate and multivariate analysis denoted that stress increased the risk of hypertension in the elderly.(OR= 7.29, 95% CI= 2.06-25.82, P-value = 0.002). Stress can affect the circulatory system. It can increase the resistance of blood vessels, and cardiac output by stimulating the sympathetic nervous system. This causes high blood pressure. (18) Emotional stress can increase blood pressure immediately (60). This finding corresponded with the studies of

Krieger (77), Theorell (20), Pickering and Gerin (78), all of whom reported that stress and anger were important risk factors of hypertension.

- **Smoking behavior** The multivariate analysis denoted that smoking significantly associated with hypertension in the elderly (OR=2.66, 95% CI= 1.25-5.65, P-value = 0.011). The result agreed with the study of Vichai Tanpaichitr (67) and Sleight (70) also found that the prevention of coronary heart disease and hypertension in the elderly involved cessation of smoking, regular exercise, and reduction of consuming fatty and salty food.

- **Drinking behavior** The association between alcohol consumption and hypertension in the elderly was found in the study after adjusting for confounding bias with the odds ratio 2.94 (OR=2.94, 95% CI= 1.40-6.20, P-value = 0.004). The result corresponded with Aoravee Trokee (52) and Sawet Nontakanun (63) reported that alcohol drinking was the main risk factor of hypertension.

CHAPTER VI

CONCLUSION AND RECOMMENDATION

Study summary

The risk factors of hypertension in the elderly include stress (OR_{adj}=7.29), consuming greasy food (OR_{adj}=6.03), consuming salty food (OR_{adj}=4.92), non-exercise (OR_{adj}=4.84), history of diabetes mellitus (OR_{adj}=4.16), genetics (OR_{adj}=4.48), alcohol drinking (OR_{adj}=2.94), smoking (OR_{adj}=2.66), history of heart and cardiovascular disease (OR_{adj}=2.22), and malnutrition was the protective factor (OR_{adj}=0.19).

Recommendation on study result

A prevention guideline for hypertension can be inferred from the above factors obtained from this study. The patients should be informed about knowledge and health care to avoid these risk factors. The patients can take care of themselves by:

1. Avoiding obesity and fatty food consumption. As the elderly require less energy during their daily activities, it is necessary to reduce high calorie food, such as carbohydrate and fat. Male elderly should limit their food intake to less than 2,200 kilocalories. Female elderly should limit their food intake to not over 1,600 kilocalories which is enough for the demands of the body. In addition, fatty food also aggravates hypertension and heart disease which are the main causes of death in the elderly.

2. Avoiding consuming salty food, smoking, and drinking. High sodium intake (salty food usually consists of sodium) was associated with high blood pressure level (19,62). Sodium increases blood volume and the resistance of the circulation. Smoking can be dangerous to patients with myocardial ischemia. Alcohol drinking is the main risk factor of hypertension.

3. Changing exercise behavior. The patient should exercise consistently and correctly. (Exercising more than 2-3 times per week, taking at least 30 minutes each time.). Regular exercise is necessary for hypertensive elderly. It encourages the efficiency of heart pumping and increases free fatty acid metabolism. In addition, it can reduce the cholesterol level in blood and atherosclerosis. Moreover patients can also lose weight and relax from stress. Therefore, exercise can decrease the blood pressure level.

4. Avoiding stress. Stress can affect the circulatory system. It can increase the resistance of blood vessels and cardiac output by stimulating the sympathetic nervous system. This causes high blood pressure.

5. Having regular annual check-up including the blood pressure.

6. The individual with a history of cardiovascular disease, diabetes mellitus or a family history of hypertension should have their blood pressure checked regularly.

Currently, primary hypertension tends to be more common because of the change of environment and the way of life in the society (13). Therefore, everybody should be careful and avoid the risk factor of hypertension.

Recommendation for further study

1. This kind of study should be repeated in other hospitals or even in the communities. This study analyzed on the patient at Police Hospital only so the result cannot refer to other group.
2. Stress measurement. The further study may use other form of stress measurement because Survey of behavioral risk factors on major non communicable diseases by Ministry of public health instrument might not be the best method for measuring stress. It did not specific for hypertensive patients.
3. Further study regarding medical and biochemical factors such as calcium level and cholesterol level should be done.

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APPENDIX

Questionnaire (English)

Faculty of Medicine , Siriraj Hospital , Mahidol University

Form No.....

Subject: Factors associated with primary hypertension in elderly adults.

Name of patient_____H.N._____

Address_____

TEL._____

Date of interview _____

The level of blood pressure

- Systolic _____ mmhg.
- Diastolic_____mmhg.

Socio -demographic data

1. Sex

   ☐ 1. Male ☐ 2. Female

2. Age _____years (full years)

3. Marrital Status

   ☐ 1. Single ☐ 2. Married ☐ 3. Widowed ☐ 4. Divorced

4. Weight _____kg.

   The lenght from base of middle finger to sternum ____meter(s).

5. Occuption

   ☐ 1. Unemployed

   ☐ 2.Business

   ☐ 3. Labor

   ☐ 4. Employee

   ☐ 5. Farmer

   ☐ 6. Retired government officer

☐ 7. Others, _____

6. Educational level

☐ 1. No formal education

☐ 2. Primary School

☐ 3. Secondary School

☐ 4. Vocational School

☐ 5. Bachelor degree or higher

☐ 6. Others, _____

7. Monthly income _____ baht.

8. Is family income sufficient to the expenses ?

☐ 1. Insufficient

☐ 2.Sufficient

☐ 3.Some money left for saving

9. How many members in the family ? _____(excluding patient)

10. Genetics - Is there any hypertensive patient in your family ? (excluding you)

☐ 1. No

☐ 2. Yes, who is my _____.

Behavioral data

11. Behaviour of consuming

Types of food	Never	Everyday	2-3 times/week	once a week
1. Fatty food 2. Salty food 3. Vegetarian food				

12. Smoking

☐ 1. Never

☐ 2. Used to smoke _____cigarette(s)/day for __years

Quit smoking for _____years.

☐ 3. Still smoking ____cigarette(s)/day for _____years.

13. Alcohol consuming

☐ 1. Never

☐ 2. Still drinking ____glass(es)/bottle(s)/day/week/month

Dranke for_____years

Quit drinking for _____years.

14. Kinds of alcohol

☐ 1. White liquor

☐ 2. Whisky

☐ 3. Beer

☐ 4. wine

☐ 5. Others, _____

15. Physical exercise, please identify _____

☐ 1. Everyday ☐ 3. Once a week

☐ 2. 2-3 days / time ☐ 4. Never

16. If you exercise, you exercise _____hr.____min. each time

Health data

1. Have you ever had with the following diseases ?

Diseases	Never	Ever	Still being sick
1. Diabetes mellitus			
2. Coronary heart disease			
3. Other heart disease			
4. Renal disease			

Psychosocial data

The questionnaire of Survey of behavioral risk factors on major non communicable diseases by Ministry of Public Health consists of 20 questions. Please answer every question that describes your symptoms and feelings.

1. Do you have any health problem now?

☐ 1. Yes ☐ 2. No

	Always	Seldom	Never
2. Do your hands shake and annoy you?			
3. When your hands and feet sweat, do you feel annoyed?			
4. Have you ever felt that your heartbeat is fast and unusual?			
5. When you wake up in the morning, have you ever feel exhausted and weakened?			
6. Do you have a problem with insomnia or sleeping problem?			
7. Have you ever had any unusual symptom of your stomach?			
8. Do you often have a nightmare?			
9. Do you have sweat and feel cool when you are frightened?			
10. Have you ever felt any pain by no reason?			
11. Have you ever smoked?			
12. Have you ever felt boring with food?			
13. Does your sickness affect to your job?			
14. Have you ever felt weakened and did not want to move?			
15. Do you often feel dazed or dizzy?			
16. When you are upset, does your weight reduce?			
17. Do you breathe uneasily or feel tired by not exercising?			

	Always	Seldom	Never
18. In general, do you think you are strong or able to succeed any activities?			
19. You are contented.			
20. You have thought that there is nothing of value in this world.			

Questionnaire (Thai)

คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล

แบบสัมภาษณ์เลขที่.....

เรื่อง ปัจจัยที่มีความสัมพันธ์กับโรคความดันโลหิตสูงชนิดไม่ทราบสาเหตุในผู้สูงอายุ

ชื่อ-นามสกุลผู้ป่วย.....H.N.....

ที่อยู่.....

TEL.....

วันที่สัมภาษณ์.....เดือน.....พ.ศ.....

ระดับความดันโลหิตที่วัดได้

- Systolic.....mmhg.
- Diastolic.....mmhg.

ข้อมูลพื้นฐานทางประชากร เศรษฐกิจ และ สังคม

1. เพศ

   ☐ 1. ชาย ☐ 2. หญิง

2. อายุ.....ปี (อายุเต็มปี)

3. สถานภาพสมรส

   ☐ 1. โสด ☐ 2. คู่ ☐ 3. หม้าย ☐ 4. หย่า

4. น้ำหนัก.....กิโลกรัม

   ความยาวจากฐานนิ้วกลางถึงกระดูกกึ่งกลางหน้าอก ยาว.....เมตร

5. อาชีพในอดีต

   ☐ 1. ไม่ได้ประกอบอาชีพ

   ☐ 2 ค้าขาย

   ☐ 3. รับจ้างแรงงาน

   ☐ 4. รับจ้างในสำนักงาน

   ☐ 5. ทำนาไร่สวน

   ☐ 6. รับราชการ

   ☐ 7. อื่นๆ ระบุ .....

6. จบการศึกษาสูงสุด
   - ☐ 1. ไม่ได้เรียนหนังสือ
   - ☐ 2. ประถมศึกษา
   - ☐ 3. มัธยมศึกษา
   - ☐ 4. ประกาศนียบัตร หรือ อนุปริญญา
   - ☐ 5. ปริญญาตรี หรือ สูงกว่า
   - ☐ 6. อื่นๆ ระบุ.....
7. รายได้เฉลี่ยต่อเดือน.....บาท
8. รายได้ครอบครัวเพียงพอกับค่าใช้จ่าย
   - ☐ 1. ไม่เพียงพอ
   - ☐ 2. พอกินพอใช้
   - ☐ 3. มีเหลือเก็บสะสม
9. จำนวนสมาชิกในครอบครัว.....คน (ไม่รวมตัวผู้ป่วย)
10. พันธุกรรม บุคคลในครอบครัวของท่าน (ยกเว้นท่าน) มีใครเป็นโรคความดันโลหิตสูงหรือไม่
    - ☐ 1. ไม่มี
    - ☐ 2. มี เกี่ยวข้องกับท่านเป็น.....

ข้อมูลทางด้านพฤติกรรม

11. พฤติกรรมการบริโภค

ชนิดของอาหาร	ไม่บริโภค	ทุกวัน	สัปดาห์ละ 2-3 ครั้ง	สัปดาห์ละ 1 ครั้ง
1. อาหารมันมาก ๆ 2. อาหารรสเค็มจัด 3. อาหารมังสะวิรัติ				

12. บุหรี่

☐ 1. ไม่เคยสูบ

☐ 2. เคยสูบบุหรี่.....มวน /วัน เป็นเวลา.....ปี เลิกมา.....ปี

☐ 3. สูบบุหรี่.....มวน/วัน เป็นเวลา.....ปี

13. สุรา

☐ 1.ไม่เคยดื่มสุรา

☐ 2.ดื่มสุรา ..... กึ๋ง หรือ เป๊ก / กั๊ก / ขวดแบน / ขวดกลม

ในเวลา 1 วัน / สัปดาห์ / เดือน

เป็นเวลา.....ปี เลิกมาแล้ว.....ปี

14. ชนิดของสุรา

☐ 1. เหล้าขาว ☐ 4. ไวน์

☐ 2. วิสกี้ ☐ 5. อื่น ๆ ระบุ.....

☐ 3. เบียร์

15. การออกกำลังกาย ระบุ.....

☐ 1. ทุกวัน ☐ 3. สัปดาห์ละครั้ง

☐ 2. 2-3 วัน / ครั้ง ☐ 4. ไม่ได้ออกกำลังกาย

16. ถ้าออกกำลังกาย ท่านออกกำลังกายครั้งละ.....ชั่วโมง.....นาที

ข้อมูลด้านสุขภาพ

17. ท่านเคยป่วยหรือกำลังป่วยด้วยโรคเหล่านี้หรือไม่

โรค	ไม่เคย	เคย	กำลังป่วย
1. โรคเบาหวาน			
2. โรคหลอดเลือดหัวใจ			
3. โรคหัวใจ			
4. โรคไต			

ข้อมูลด้านจิตสังคม

แบบสัมภาษณ์ความเครียด จากการสำรวจพฤติกรรมที่มีผลต่อการเกิดโรคไม่ติดต่อของประชาชนไทย กระทรวงสาธารณสุข ประกอบด้วยคำถาม 20 ข้อ

กรุณาตอบให้ครบทุกข้อที่ตรงกับอาการและความรู้สึก

1. ขณะนี้คุณมีปัญหาเกี่ยวกับสุขภาพหรือไม่

☐ 1. ไม่มี ☐ 2. มี

	บ่อยครั้ง	นาน ๆครั้ง	ไม่เคยเลย
2 .มือคุณสั่นถึงขนาดทำให้คุณรำคาญบ้างหรือไม่	.....	.....	.....
3. ตอนที่มือ-เท้า คุณมีเหงื่อออกมันชื้นแฉะจนทำ ให้คุณรำคาญบ่อยหรือไม่	....	....	....
4. คุณเคยอยู่เฉยๆ ก็รู้สึกว่าใจสั่นหรือใจเต้นแรงผิดธรรมดาหรือไม่	....	....	....
5. เมื่อคุณตื่นตอนเช้าคุณเคยรู้สึกเซ็ง และละเหี่ยท้อแท้บ้างหรือไม่	....	....	....
6.. คุณมีปัญหา เกี่ยวกับการนอนไม่หลับหรือ หลับ ๆตื่น ๆ บ้างหรือไม่	....	....	....
7. คุณเคยมีอาการผิดปกติเกี่ยวกับท้องของคุณบ่อยไหม	.....	.....	.....
8. คุณเคยฝันร้ายบ่อยหรือไม่	.....	.....	.....
9. คุณเคยเหงื่อออก-ตัวเย็น เพราะตกใจหรือไม่	.....	.....	.....
10. คุณเคยรู้สึกว่าเจ็บที่นั่นปวดที่นี่โดยไม่รู้สาเหตุหรือไม่	.....	.....	.....
11. คุณเคยสูบบุหรี่บ้างหรือไม่	.....	.....	.....
12. คุณเบื่ออาหารบ้างหรือไม่	.....	.....	.....
13. การเจ็บป่วยมีผลกระทบกระเทือนต่อการงานของคุณบ้างหรือไม่	....	....	....
14. คุณเคยอยู่เฉยๆก็รู้สึกไม่มีแรงไม่อยากแม้แต่จะเคลื่อนไหวบ้างหรือไม่	....	....	....
15. คุณเคยรู้สึกมึนงง หรือ เวียนหัวบ่อยหรือไม่	.....	.....	.....
16. เมื่อกลุ้มใจคุณมักจะน้ำหนักลดหรือเพิ่มใช่ไหม	.....	.....	.....
17. คุณรู้สึกหายใจขัดหรือมีอาการหอบเหนื่อย โดยไม่ได้ออกกำลังกายบ้างไหม	.....	.....	.....

	บ่อยครั้ง	นาน ๆครั้ง	ไม่เคยเลย
18. โดยทั่วไปแล้วคุณคิดว่าคุณแข็งแรงหรือมีความสามารถพอที่จะกระทำกิจกรรมต่างๆที่คุณอยากทำให้ลุล่วงได้ใช่ไหม	.....	.....	.....
19. คุณรู้สึกสบายใจ	.....	.....	.....
20. คุณเคยคิดว่าโลกนี้ไม่มีสิ่งใดมีค่าเลย	.....	.....	.....

BIOGRAPHY

NAME Pol. Capt. Poonrut Leyatikul

DATE OF BIRTH 25 February 1969

PLACE OF BIRTH Pracheenburi, Thailand

INSTITUTIONS ATTENDED Police Nursing College, 1987-1991

Bachelor of Science in Nursing

Mahidol University, 1997

Certificate in Infection Control Nursing Specialty

Mahidol University, 1998-2000

Master of Science (Epidemiology)

POSITION & OFFICE 1991 - 2000, Department of Pediatric

2000 - Present, Infection control section

Police General Hospital

Patumwan District

Bangkok Provice 10330

Position: Registered Nurse

(Infection control nurse)