SIX-MINUTE WALK TEST IN ELDERLY THAIS AGED 60-80 YEARS FROM ELDERLY CLUBS IN BANGKOK

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SIX-MINUTE WALK TEST IN ELDERLY THAIS AGED 60-80 YEARS FROM ELDERLY CLUBS IN BANGKOK

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ABSTRACT

This study aimed to measure the six-minute walk distance (6MWD) in elderly Thais from elderly clubs in Bangkok, to identify the factors related to the walk distance and to establish reference equations for predicting the total distance walked during six minutes for elderly Thais.

One-hundred and fifty healthy elderly Thais aged 60-80 performed a six-minute walk test using standardized protocol. Other measurements included anthropometric data, physical activity level, quality of life, pulmonary function, strength, and balance.

The average 6MWD observed in this study was 434 ± 75 m. The 6MWD was significantly correlated with age ($r = -0.390$, $p < 0.01$), BMI ($r = -0.215$, $p < 0.01$), height ($r = 0.196$, $p < 0.05$), functional reach test ($r = 0.630$, $p < 0.01$), hand grip strength ($r = 0.447$, $p < 0.01$), Force vital capacity (FVC) ($r = 0.429$, $p < 0.01$), Force expiratory volume in 1 second (FEV_1) ($r = 0.417$, $p < 0.01$), Short-form health survey (SF-36) physical functioning part ($r = 0.319$, $p < 0.01$), general health part ($r = 0.186$, $p < 0.05$), and vitality part ($r = 0.174$, $p < 0.05$). Stepwise multiple regression analysis showed that functional reach distance, SF-36 physical functioning score, and FEV_1 were independent predictors of 6MWD ($p < 0.05$), explaining 54 % of the variance.

The 6MWD in this study was close to the values previously reported in Asian but less than ones from the European studies. Promoting balance, physical performance, and pulmonary function is important for improving the six-minute walk ability in healthy, elderly Thais.

KEY WORDS: SIX-MINUTE WALK TEST/ ELDERLY / FUNCTIONAL STATUS / PHYSICAL PERFORMANCE

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การทดสอบเดิน 6 นาที ในผู้สูงอายุไทยช่วงอายุ 60-80 ปี จากชมรมผู้สูงอายุในกรุงเทพมหานคร

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คณะกรรมการที่ปรึกษาวิทยานิพนธ์: มัณฑนา วงศ์ศิรินวรัตน์, Ph.D., วิมลวรรณ เหียงแก้ว, Ph.D.

บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อหาค่าระยะทางปกติของการทดสอบเดิน 6 นาทีในผู้สูงอายุไทยสุขภาพดีช่วงอายุ 60-80 ปี ระบุปัจจัยที่สัมพันธ์กับระยะทางที่ได้ในการทดสอบและสร้างสมการเพื่อใช้พยากรณ์ระยะทางที่ผู้สูงอายุเดินได้ใน 6 นาที

ผู้สูงอายุไทย 150 คนได้รับการทดสอบด้วยการเดิน 6 นาทีด้วยวิธีมาตรฐาน ปัจจัยอื่นที่ประเมินได้แก่ สัดส่วนของร่างกาย ระดับการทำกิจกรรม คุณภาพชีวิต สมรรถภาพปอด ความแข็งแรงของกล้ามเนื้อและการทรงตัว

ค่าเฉลี่ยของระยะทางการเดิน 6 นาทีในผู้สูงอายุไทยในการศึกษานี้เท่ากับ 434±75 เมตร ปัจจัยที่สัมพันธ์กับระยะทางที่เดินได้แก่ อายุ (r=-0.390, p<0.01) ค่าดัชนีมวลกาย (r=-0.215, p<0.01) ความสูง (r=0.196, p<0.05) ระยะเอื้อมมือขณะทดสอบการทรงตัว (r=0.630, p<0.01) แรงบีบมือ (r=0.447, p<0.01) ค่าปริมาตรอากาศที่หายใจออกเต็มที่หลังจากหายใจเข้าเต็มที่ (FVC) (r=0.429, p<0.01) ค่าปริมาตรอากาศหายใจออกอย่างแรงใน 1 วินาทีแรก (FEV_1) (r=0.417, p<0.01) แบบประเมินคุณภาพชีวิต SF-36 ส่วนสมรรถภาพทางกาย (r=0.319, p<0.01) ส่วนการรับรู้ภาวะสุขภาพทั่วไป (r=0.186, p<0.05) และส่วนความรู้สึกมีชีวิตชีวา (r=0.174, p<0.05) เมื่อวิเคราะห์ข้อมูลโดยใช้ Stepwise multiple regression พบว่าระยะเอื้อมมือขณะทดสอบการทรงตัว คะแนนคุณภาพชีวิตจากแบบประเมิน SF-36 ส่วนสมรรถภาพทางกาย และค่าปริมาตรอากาศหายใจออกอย่างแรงใน 1 วินาทีแรก (FEV_1) เป็นปัจจัยทำนายระยะทางการเดิน 6 นาทีโดยสามารถอธิบายผลได้ร้อยละ 54 ของความแปรปรวนทั้งหมด

การศึกษานี้ได้ค่าระยะทางการเดิน 6 นาทีในผู้สูงอายุไทยซึ่งมีค่าใกล้เคียงกับผลการศึกษาที่ผ่านมาในเอเชีย แต่น้อยกว่าเมื่อเปรียบเทียบกับผลการศึกษาของยุโรป การเพิ่มระดับความสามารถในการทรงตัว สมรรถภาพทางกาย และสมรรถภาพปอด อาจเป็นปัจจัยสำคัญที่จะเพิ่มความสามารถในการเดิน 6 นาทีในผู้สูงอายุไทย

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LIST OF ABBREVIATIONS

6MWT	=	Six minute walk test
6MWD	=	Six-minute walk distance
BMI	=	Body mass index
FVC	=	Force vital capacity
FEV1	=	Force expiratory volume in 1 second
SF-36	=	Short-form health survey
ADL	=	Activity daily living
NYHA	=	New York Heart Association
FRC	=	Functional residual capacity
RV	=	Residual volume
VC	=	Vital capacity
COPD	=	Chronic obstructive pulmonary disease
SpO_2	=	Oxygen saturation
ICC	=	Intraclass correlation coefficients
kg	=	Kilogram
cm	=	Centimeter
m	=	Meter
l	=	liter
s	=	second

CHAPTER I
INTRODUCTION

In Thai population, the change of aging structure is rapidly leading the country toward elderly society. Information from the Office of the National Economic and Social Development Board showed that in the year of 2000, the number of Thai elderly males and females were 8.7 % and 10.3 % respectively and these numbers increase to 10.6% and 12.8% in 2010 (1, 2). There are many factors that make people having longer period of life such as the effectiveness of medical procedures, the higher education and the health concerning lifestyle.

As a person gets older, many systems of the body change. For example, the musculoskeletal system, the muscular strength and endurance decrease, the contraction time increases, osteoporosis develops, the risk of falls and fractures increases and the range of motion diminishes. For the neurological system, the elderly has impaired balance which is the main factor resulting in high risk of falls. Perception and motor processes are also declined. There are also the decrease in the ability of the cardiopulmonary system to supply oxygen to exercising muscles and the ability of these muscles to use oxygen in energy metabolism so the elders usually had reduced physical performance (3).

These factors are the main causes that make the elderly having considerable risk of health problems and often limit capacity in order to fulfill functional activities of daily living. These may force the elderly to have independent lifestyle and to decrease quality of life (4).

There are many methods to evaluate the cardiorespiratory performance such as the bicycle ergometer or treadmill, step test, shuttle walk test, and six-minute walk test. All tests are used as the index of the effective work of the body systems so these tests could be utilized in patients to assess the progress of treatment, as well as to predict the prognosis of disease.

Six-minute walk test (6MWT) is a test that commonly used for assessing the cardiopulmonary performance in the rehabilitation program because it is valid and reliable for detecting the level of exercise capacity in patients. The test detects the distance of walking that a patient can perform on a flat, hard surface in a period of six minutes. The six-minute walk test is considered as a practical and simple test. No exercise equipments or advanced training of the evaluator is needed. Not only the ability to closely reflect the performance in daily living, but it also can be performed by many frail and disable patients who would not tolerate cycle ergometer or treadmill exercise test which is the “gold standard” (5-7). Furthermore, the six-minute walk test reflects several body systems involving exercise such as the peripheral circulation, as well as neuromuscular units, systemic circulation, the pulmonary and cardiovascular system. In addition, the distance of the six-minute walk test has been shown to be reduced by conditions such as chronic obstructive lung disease, arthritis, cardiovascular disease and neuromuscular disorders (8-10).

Six-minute walk test is not only the tool for assessing the cardiopulmonary performance but it has also been used for assessing the performance in the patients with musculoskeletal disorders, especially osteoporosis or hip/knee arthoplasty (11-15). Moreover, the six-minute walk test is a useful instrument for evaluating the exercise capacity of elderly person because it can predict the functional status in this age group and has higher validity than other procedures such as chair stand time or lifting (16).

Because the six-minute walk test is the test that involve many systems of the body to perform, it has many factors related to the walk distance such as anthropometry, muscle strength, balance, habitual physical activity, and psychological factor. There were some studies trying to address factors which could predict the six-minute walk distance (4, 7, 10, 17-19). However, the previous researches addressed a variety of factors and the results were inconclusive.

The studies of six-minute walk test in healthy elderly are still warrented for identifying the factors contributing to the walking distance. The normal walking distance in Thai elderly population is also needed because there is paucity of six-minute walk distance reference values from population-based healthy subjects which limits the interpretation of six-minute walk distance in patients (17, 20).

Although there were some studies of the six-minute walk test in healthy elderly in caucasian, the difference in race, structure of body system, lifestyle, culture and attitude might effect the results. Therefore, the aim of this study is to evaluate the distance which the Thai elders from elderly clubs in Bangkok can walk in six minutes period, to identify the factors related to six-minute walk distance in Thai elders and to establish reference equations for prediction of the total distance walked during six-minutes for elderly.

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Purposes of the Study

General objective

To measure the distance walked in a Thai elders from elderly clubs in Bangkok, to identify the factors related to six-minute walk distance including physical activities, quality of life, pulmonary function, strength and balance and to establish reference equations for prediction of the total distance walked during six-minutes for elderly.

Specific objectives

1. To determine the association between six-minute walk distance and anthropometric data.
2. To determine the association between six-minute walk distance and the physical activity scores.
3. To determine the association between six-minute walk distance and quality of life (SF-36) scores.
4. To determine the association between six-minute walk distance and pulmonary function test.

5. To determine the association between six-minute walk distance and hand grip strength.
6. To determine the association between six-minute walk distance and Functional balance test.
7. To establish reference equations for prediction of the total distance walked during six-minutes for elderly.

Measured Variables

- Age (years)
- Weight (kg.)
- Height (m.)
- BMI (kg/m^2)
- Leg length (cm.)
- Physical activity scores
- Quality of life assessment (SF-36) scores
- Pulmanary function test variables: FVC (l), FEV_1 (l), FVC/ FEV_1 (%)
- Hand grip strength (kg.)
- Functional reach (inch)
- Walk distance (m.)

Scope of the study

This study evaluated the status and performance of Thai elders aged 60 to 80 years from elderly clubs in Bangkok area using physical activity level, quality of life (SF-36), pulmonary function test, hand grip strength, functional reach test and six-minute walk test and determined the correlation between the six-minute walk distance and these measurements.

Advantages of the study

The results of the study provided the information about the six-minute walking distance in Thai elderly aged 60 to 80 years from elderly clubs in Bangkok. Furthermore, the results indicated the factors that could predict the six-minute walk distance that could be applied in the planning of rehabilitation program.

CHAPTER II
LITERATURE REVIEW

2.1 Aging

The World Health Organization (WHO) (21) has defined "elderly" as a person who have the age in the range of 60-74 years, "old" as a person who have the age in the range of 75-90 years, and "very old" as a person who have the aged over 90 years. However, sometimes chronological age does not reflect biological age because all organs in an individual do not necessarily age at the same rate in different individuals.

The number of persons over age over 65 years has increased since the turn of the century, with the most dramatic increase occurring in the number of person 85 years of age and over. For Thai elderly population, information form the Office of the National Economic and Social Development Board showed that in the year 2000, the number of Thai elderly males and females were 8.7 % and 10.3 % respectively and it would increase to 10.6% and 12.8% in 2010 (1, 2). As these numbers grow, there is a corresponding rise in the number of older persons with disability (20). These phenomena appear as a result of various changes in aging.

2.2 Physiological Changes in Aging

Physiological changes are the main causes that make high risk of the disease in elderly (22). There are many systems involving the physiological alteration, for instance the systems of musculoskeletal, cardiovascular, pulmonary and neurological.

2.2.1 Musculoskeletal system

Muscle

Strength losses among elderly individuals are substantially associated with their limited mobility and physical performance (23). After the age of 45, there is a decrease in muscle strength. The progression is slow at first and then more rapid after middle age. The rate of decreasing is 1.5 % per year and some muscles may be declined 5-7 % per year after the age over 70 years. Aging is found to associate with decrease in muscle mass caused by loss of muscle fiber numbers and decreases in individual muscle fiber sizes, especially type II fibers (fast twist). This leads to a progressive decrease in cross-sectional area of muscle. The cause of reducing in muscle fibers is the decrease in number of anterior horn cell especially in lumbosacral expansion of spinal cord. In elderly, immobilization and disuse of muscle are also the main factors that make the muscle atrophy (23, 24).

Hand-grip strength is an estimate of isometric strength in the upper extremity. It also correlates with strength of other major muscle groups and therefore has been taken as an estimate of the “overall strength”(25). In 2006 (26), Frederiksen et al studied the age trajectory of hand-grip strength in subjects aged 45 or older, and the normal data of this measurement became the assessment tool in health and functioning of the elderly. The participants in this study came form three large nationwide population-based surveys of Danes. There were totally 8,342 subjects, aged 45-102 years. All participants performed the grip-strength measurement. Two-year follow-up was done in 2,827 subjects and four-year follow up was done in 1,539 subjects. The results showed that the grip-strength decreased throughout life for both males and females, especially among the oldest women. The course of the decline is estimated by using full information in the longitudinal data and was found to be almost linear in the age span of 50 to 85 years. In this age span, mean annual grip-strength loss was estimated to be 0.59 kg. (SEM = 0.02) for men and 0.31 kg. (SEM = 0.01) for women. The authors concluded that the courses of the age-associated decline in grip strength took place from age 45 and onward. Equations of expected grip strength, as well as tables with sex-, age-, and height-stratified reference data, provided an opportunity to include grip-strength measurement in clinical care in this population.

In 2007, Sasaki et al investigated grip strength-mortality association in 4,912 participants (1,695 men and 3,217 women) aged 35 to 74 in Hiroshima. They performed grip strength test 2 times for both left and right hands in standing position. Other measurements included medical history, general physical examination i.e., blood pressure, anthropometrical examinations such as height, weight, BMI and laboratory tests. Mortality was followed-up for the entire study sample from the time of grip-strength examination in 1970-1972 until the end of 1999. The results showed the averaged grip strength by age- and sex-specific categories. A gradual decrease was apparent in both sexes. In all age and sex groups, a decreasing trend of mortality by increment of grip strength was observed. However, even after 20 years of follow-up, relative risk (RR) of mortality associated with grip strength was significantly lower for 5-kg. increment. The authors concluded that grip strength was a strong and consistent predictor of mortality in middle-aged and elderly person (27).

Bone

The maximal bone mass is present at the age of 25-30 and will be rather stable to the age of 40. After that there is the change in osteoclastic activity to exceed the osteoblastic activity leading to the loss of bone mass in elderly. Additionally, the influence of increasing parathyroid hormone in elderly to maintain the blood calcium level will further increase the rate of osteoclastic activity (24). The bones of older persons invariably are less dense than the bones of younger persons. The loss of bone mass depends on gender and bone type. In both sexes, the bone density begins to decline after the age of 40. In male, the rate of loss throughout life is approximately 0.5% per year. In female, a similar rate of loss occurs until the age of 50 and after the age of 65 while a more rapid rate of bone loss of 2.5 to 3.0% per year. In men of all ages, and in women over the age of 65, similar reductions occur in the density of both cortical and trabecular bones. In contrast, the loss of bone in women around the time of the menopause appears to affect the trabecular bone selectively, with the horizontal trabeculae showing the greatest reduction in both thickness and number. The reduction in density may be the result of failure in the development of either the organic or inorganic component of bone, a condition known as osteoporosis (28-32).

Osteoporosis is a disease characterized by low bone mass and deterioration of bone tissue, resulted from imbalance between resorption and formation of bones. This leads to increase bone fragility and risk of fracture, particularly of the hip, spine, and wrist. This condition is often known as “the silent thief” because bone loss occurs without symptoms (28-32).

Joint

In elderly, there is a loss of elasticity of articular cartilage because shortening of chondroitin sulphate and increase in enzyme hyaluronic acid. These cause the water in cartilage to decline. Decreased hydration, reduced elasticity, and increased fibrous growth around bony prominences contribute to increased stiffness and decrease functioning (23, 24).

2.2.2 Cardiovascular system

Heart Morphology

With aging, morphological changes of the heart including increasing thickness of the ventricular walls, dilation and stretching of the valves, calcification of the valves and coronary arteries as well as increased deposition of epicardial fat are the common occurrences. The most prominent age-related changes are increased calcification and thickening elastic fragmentation. All of these biological and structural changes result in physiologic and functional alterations of the cardiovascular system (23, 24, 33).

Heart rate

Although resting heart rate does not change by aging, there is an inherent heart rate decrease at exertion. The maximal heart rate achievable at peak exercise level declines linearly with age. Heart rate responses to orthostatic stress, valsalva maneuver and breath holding are decreased because the number and sensitivity of beta-adrenergic receptor declines (23, 24).

Cardiac output

At resting, the cardiac output and stroke volume do not change by age. During exercise, the cardiac output of the older is increased following work load in the same manner as the younger adults. However, the cardiac output in the elderly is increased more than the younger adults at the same work load because there is a reduced sympathoadrenergic responsiveness to the need of increased cardiac output. The rise in cardiac output induced by exercise in the elderly is not achieved by raising the heart rate as occuring in young people (23, 24).

Ejection fraction

Ejection fraction is the main index of the left ventricular performance. It does not decrease by age during resting. However, it decreases by age while exertion because myocardial contractile response to the increase load which induces the beta-adrenergic stimulation is declined (23, 24).

Blood pressure

Blood pressure is usually expressed as the systolic and diastolic pressures. The product of the total peripheral resistance and the cardiac output define the mean blood pressure. With aging, the diastolic blood pressure increases up to about 70 years of age then decreases due to the increased volume in the large central arteries. Systolic pressure in the aorta and pulse pressures are also increased with age. Late systolic pressure exceeds early systolic pressure in the elderly and the index of the elastance and peripheral resistance are increased with age (23, 24, 30, 31).

2.2.3 Pulmonary system

In the pulmonary system, age changes can be organized according to the mechanical properties, changes in flow, changes in volume, alteration in gas exchange, and impairments of lung defense (22-23, 28). The physiological changes that have been identified in older people lungs include a reduction in elasticity that is postulated to reduce lung compliance and recoil, with an increase in collapse of small airways during expiration. The ability of the chest to increase in volume with to generate negative intrathoracic pressure during inspiration reduces with age. Muscle strength and joint range of movement which determine the amount of movement become stiffer in the older person (29).

Ventilation, diffusion, and pulmonary circulation are the three major components of the respiratory system that lose efficiency with age. There is an increased thickening of the supporting membranes between the alveoli and the capillaries, a decline in total lung capacity, and a decrease in the resiliency of the lungs. The normal lung has a large reserve capacity that can meet ventilation requirements even during maximal exercise. This reserve capacity begins to diminish after the age of 30 and then accelerates after 60 years of age (23, 28).

The reduced physiological capacity evidented with ageing influences the ability to perform many tasks, potentially affecting quality of life. In 2005, Watsford et al studied in the Australian population and found the relationship between respiratory muscle function and physical performance. In addition, they examined the influence of age on respiratory function. They studied 72 healthy older adults aged between 50 to 79 years, 36 males, 36 females. Pulmonary function, respiration muscle strength, inspiratory muscle endurance and 1.6 km. walking performance were examined in all subjects. The results showed that there were no significant ages by gender effects for any variables. Aging was significantly related to reduced respiration muscle function and walking capacity within each gender. They concluded that partial correlations controlling for age indicated that expiratory muscle strength was significantly related to walking performance, while inspiratory muscle endurance cooperated significantly to walking performance in all participants (34).

2.2.4 Nervous system

Aging is often characterized by reductions in sensibility, coordination and cognitive abilities to react to changing circumstances. The functional deficits of aging in the nervous system may be explained in terms of a combination of loss of neurons, dendrites and synapses, microscopic changes in senescent neurons, changes in nerve conduction, and changes in neurotransmitter mechanisms. Conduction velocity of the central nervous system has been shown to decrease with advancing age. Balance impairment partially results from cerebellar losses, and now coupled with central nervous system delays. This might be the main reason why an older person has a greater tendency to fall and less ability to quickly correct a center of balance before injury occurs (23, 24, 28, 33)

The functional reach is a simple test designed in 1990 by Duncan et al (35) to measure functionally the limit of dynamic postural control with one arm in standing. It has been documented good test-retest and interrater reliability and predictive, criterion, and concurrent validity (35-37). The interrater reliability was 0.98 (ICC (3,1)). Test-retest reliability was reported the ICC (3,1) of 0.92 (35-36). Weiner et al studied the rehabilitation improvement with functional reach in 28 inpatient male veterans undergoing physical rehabilitation and 13 non-rehabilitation controls. They were evaluated at baseline and every 4 weeks. Their sensitivity to change was determined using the responsiveness index (RI). The results showed that functional reach was found to be sensitive to change and therefore, being an appropriate measure for using in prospective clinical trials (38).

2.3 Six-minute Walk Test

Assessment of functional capacity by walking tests has been around since the 1960s. Cooper et al were the first group developing 12-minute walk for evaluating maximum oxygen uptake. However, this test was not widespread (39). The six-minute walk test was originally introduced as a functional exercise test by Lipkin in 1986 (40). Its results were highly correlated with those of the 12-minute walk test from which it was derived. In 1985, Guyatt et al applied the six-minute walk test in patients who had chronic heart failure. The results of this study showed that this test was appropriate to assess exercise capacity (41).

In 2000, Hamilton et al studied the six-minute walk test in cardiac rehabilitation population with mild disease status. They determined the validity and reliability of this test in this population. The six-minute walk test had strong test-retest reliability (intraclass correlation = 0.97). Maximum METs was linearly related to six-minute walk test. It indicated that six-minute walk test had strong validity. Age, sex, DASI scores and the Physical Function subscale of the SF-36 were correlated with six-minute walk distance. They concluded that in phase 2 or 3 of cardiac rehabilitation population, six-minute walk test was a valid and reliable method for assessing functional ability (42).

In 2003, Nomori et al evaluated physical dysfunction during the early period after lung resection in patients with lung cancer and coexisting chronic obstructive pulmonary disease (COPD). They studied the relationship between the ratio of the forced expiration volume in 1 second to the force vital capacity (FEV_1/FVC %) and the results of six-minute walk test before and after surgery. They studied in 83 patients who performed the pulmonary function tests and the six-minute walk test three times (before surgery, one week and two weeks after surgery). The results showed that there were the correlations of six-minute walk test and FEV_1/FVC % at one and two weeks after surgery, but not with the concomitant percentage reduction in vital capacity (VC). The level of severity in COPD patients were correlated with six-minute walk distance and oxygen saturation (SpO_2) during six-minute walk test. They concluded that the decreases in six-minute walk distance and SpO_2 after surgery were significantly influenced by the FEV_1/FVC %, but not by the decrease in vital capacity. The COPD patients had a limited capacity for walking during the early period after surgery due to significant oxygen desaturation (43).

In 2006, Ameri et al evaluated the six-minute walk test in the Saudi population and examined the relationship about pulmonary function in patients with respiratory disease and six-minute walk distance. They studied in 129 patients with pulmonary disease from June 2003 to December 2004. All participants performed the six-minute walk test and pulmonary function test. The six-minute walk distance had correlation with height, but not with weight, BMI, borg scale, or oxygen saturation. The six-minute walk distance correlated significantly with FVC and had a weaker relation with FEV_1. The test had no significant correlation with lung volumetric parameters (total lung capacity, FRC, and RV). They concluded that the ability to walk for a distance was an easy way to measure exercise capacity in patients with cardiac and pulmonary diseases. Six-minute walk distance showed correlation with spirometric parameters and diffusion capacity (44).

In 2001, Solway et al reviewed the measurement properties of functional walk tests used in the cardiorespiratory domains including two-minute walk test, six-minute walk test, twelve-minute walk test, self-paced walk test, and shuttle walk test. Their data sources were MEDLINE (1966 to January 2000), CINAHL (1982 to December 1999), the major electronic databases and bibliographies of the retrieved articles. There were 31 studies of six-minute walk test in several different patient populations such as COPD, heart failure, pace-maker, peripheral arterial, surgical, and pediatric patients. Most studies aimed to evaluate the validity and reliability. There were two studies to established normal values and reference equations for the prediction of six-minute walk test distance for healthy adults aged 40 to 85 years. In COPD patients, pulmonary function test and maximal oxygen consumption were correlated with six-minute walk distance. Studies of responsiveness showed that improvement in six-minute walk distance was related to compressed breathlessness in pacemaker patients, improvement in quality of life for elderly patients with heart failure, and changes in maximal oxygen consumption in patients with COPD. They concluded that measurement properties of the six-minute walk test had been the most widely researched and certified. In addition, the six-minute walk test was easy to distribute, better tolerated, and more reflective of activities of daily living than other walk tests. Accordingly, the test was currently the choice when using a functional walk test for clinical or research purposes (45).

Previous studies showed that the six-minute walk test is appropriate for the patients who have the cardiorespiratory disease to evaluate the physical ability. About six-minute walk distance, it has the correlation with the other measurements, reflecting abilities such as the physical function subscale of the SF-36 in heart disease patients, $FEV_1/FVC\%$ in patients with respiratory disease such as COPD or lung cancer. Furthermore the six-minute walk distance is correlated to the patient's anthropometric data.

Having been used in patients with physical dysfunction, in 1998, Enright and Sherrill applied the six-minute walk as a part of comprehensive follow-up examination in healthy adults. They also determined the predictors of the six-minute walk distance. The test was performed by 290 healthy subjects, 117 males and 173 females, aged 40 to 80 years old. Before and after the test, subjects were measured oxygen saturation (SaO_2), pulse rate and the degree of dyspnea (Borg scale). The results of this study showed that the median distance walked was 576 meters for men and 494 meters for women. The six-minute walk distance was significantly less for men and women who were older and heavier, as well as shorter men. The results suggested that the six-minute walk distance had significant correlation with age, height, weight and gender (9).

Although 6-minute walk test was commonly used to estimate functional exercise capacity in patients with chronic disease, the interpretation of this test was limited. In 1999, Troosters et al conducted a study to evaluate its determining factors. They studied in 51 healthy subjects, 23 males and 28 females, aged 50-85 years old. All subjects were free of disease that could interfere performance in a walking test. The test was performed in a quiet 50 m. long corridor. Subjects were encouraged every 30 seconds to continue walking as quickly as possible. The results showed the average 631±93 meters walking distance. There were 84 meters greater distance in the male compared to female subjects. The six-minute walk test showed significant correlation with age, height, sex and weight. They concluded that the six-minute walk test could be predicted adequately using a clinically useful model in healthy elderly subjects (10).

In 1999, Harada el al studied the usefulness of six-minute walk to integrate with other measures of mobility in 86 older adults who did not have any pathology. The assessments included the six-minute walk test, chair stand, standing balance, gait speed, body mass index, and self-reported physical functioning and general health perception. The results showed that the test-retest reliability of six-minute walk test was 0.95. The six-minute walk distance was found to correlate with other parameters i.e., moderlate correlation with chair stands (r=0.67), standing balance (r = 0.52) and gait speed (r = -0.73), and low correlation with body mass index (r = -0.07). The correlation of the six-minute walk test with general health perception was 0.39. The authors concluded that the six-minute walk test was reliable and valid in relation to performance and self-reported indicators of physical functioning test. Therefore, it could serve as a useful integrated measure of mobility (46).

In 2001, Gibbons et al studied six-minute walk test in healthy adults aged 20 and over. The greatest six-minute walk distances among four repetitions in a wide age range of healthy participants were identified. In addition, they investigated the influence of demographic, anthropometrics, and habitual exercise activity on the best six-minute walk distance. The results showed that the first section walk was the best section that had the greatest distance (689 ± 96 meters). Age, height, and sex influenced the walk distance (47).

In 2002, Bean et al determined whether or not the six-minute walk test was the best representation of the functional limitation, aerobic capacity, or both. They studied in 45 older adults (34 females, 11 males) age 65 or older. The performance measures included six-minute walk test, stair climb time, habitual and maximal gait speed, and the Short Physical Performance Battery (SPPB). Muscle power and strength measurements at hip, knee, and ankle, and a submaximal treadmill exercise tolerance test were included in the physiologic measures. The results showed that the six-minute walk test was well correlated with all of the performance measures and strongly associated with performance-based measures of functional limitation. In contrast, the six-minute walk test was poorly correlated with indirect measure of aerobic capacity such as the rate-pressure product and exercise tolerance test duration. They concluded that the six-minute walk test was a measurement of functional limitation among mobility-limited elders without cardiorespiratory or peripheral vascular disease (48).

In 2002, Steffen studied whether age and gender related to the provided data of four common clinical tests namely, six-minute walk test, Berg balance scale, Timed up & Go test and gait speed. They studied in 96 community-dwelling elderly people age 61 to 89 years old. Data were analyzed by gender and age (60-69, 70-79 and 80-89 years old) cohort. The results showed that 6-minute walk test, Berg balance scale, Timed up & Go test and gait speed had high test-retest reliability (ICC = 0.95-0.97). Mean test scores showed a trend of age-related declines for the six-minute walk test, Berg balance scale, Timed up & Go test and gait speed for both male and female subjects. The authors concluded that physiotherapists should use age-related data when interpreting these clinical outcomes (49).

In 2003, Enright et al determined the correlation of the total six-minute walk distance with various clinical outcomes in a population sample of adults age 68 or over. They recruited 3,333 participants who visited the clinic and 2,281 subjects (68%) performed the six-minute walk test. The authors found that the mean of six-minute walk distance was 344 meters. Also, the shorter six-minute walk distance in women and men was correlated with the following: older aged, higher weight, larger waist, weaker grip strength, symptoms of depression and decreased mental status. Moreover, a low ankle blood pressure, use of angiotensin converting enzyme inhibitors, and arthritis in men and women; higher C-reactive protein, diastolic hypertention, and lower FEV_1 in women; and the use of digitalis in men were diseases or risk factors correlated with a shorter six-minute walk distance. Impaired activities of daily living; self-reported poor health; less education; nonwhite race; a history of coronary heart disease, transient ischemic attacks, stroke, or diabetes; and higher level of C-reaction protein, fibrinogen, or white blood cell count were also associated of a shorter six-minute walk distance. They concluded that most of the community-dwelling elderly persons can perform the six-minute walk test. The test might be used clinically to measure the impact of multiple comorbility. Factors associated with a shorter distance walked were similar to those associated with a reduced oxygen uptake at maximum exercise, cognitive function, symptoms of depression, limitation of ADL, indexes of inflammation, and the use of cardiovascular medication (7).

The six-minute walk test is not limited to use for evaluating the exercise capacity in only heart and lung patients, there were many studies determining the six-minute walk test in healthy older adults. The main purpose of most studies were to find the mean distance form the test in the population-base subjects, investigated the factor that influenced the six-minute walk distance and studied the usefulness of six-minute walk with other measurements. They found that the six-minute walk distance correlated with sex, range of age, anthropometric data and habitual exercise activity. Furthermore, the six-minute walk test is reliable and valid in relation to other physical function test.

In the elderly, health status is an important factor that represents the physical capacity. In 2004, Bautmans et al investigated the six-minute walk distance in community dwelling elderly. They found the impact of health status on six-minute walk distance. The mean six-minute walk distance was 603 meters. Male subjects who were heavier and taller had a longer distance than female. The distance decreased significantly with increasing age and worsening health status. The healthier elderly would present a better physical exercise capacity than those with a worse health condition. The authors concluded that the health status of community dwelling elderly influenced the six-minute walk distance. They also proposed a health categorizing system for elderly people which would be able to distinguish persons with lower physical exercise capacity and could be useful when advising physical trainers for seniors (4).

In 2006, Hermione et al determined the six-minute walk distance and identified the contributors to six-minute walk distance in healthy Singaporeans. They studied in 35 healthy subjects (32 Chinese, 16 men) aged between 45 to 85 years. Three times of the walking test were performed using a standardized protocol. During the six-minute walk test, heart rate (HR) was recorded each minute. Other measurements included age, height, leg length, smoking history and self-reported physical activity. The authors compared the measured six-minute walk distance with the predicted six-minute walk distance from two regression equations derives in Caucasian subjects. The results showed that six-minute walk distance was 560 ± 105 meters and was not significantly different between men and women. Age, height and leg length were related to the walking distance. Predicted six-minute walk distance using regression equation derived from Caucasian subjects exceeded measured six-minute walk distance in this study by more than 75 meters (18).

In 2006, Camarri et al, determined six-minute walk distance in a population-based sample of healthy subjects. They also aimed to identify predictors of six-minute walk distance in the group of 70 caucasian subjects (33 males) aged 55-75 years. Three times of six-minute walk test with a standardized protocol were performed. Height, leg length, weight, forced expiratory volume in 1 s.(FEV_1), exhaled carbon monoxide and self-reported physical activity including habitual walking were measured. The results showed that the average six-minute walk distance was 659 ± 62 m. (range 484-820 m). Females walked 59 ± 13 m. shorter than males. Six-minute walk distance were significantly correlated with height, weight, and FEV_1. Forwards stepwise multiple regression showed that height and FEV_1 were the independent predictors of walking distance. They suggested that height and FEV_1 were the significantly independent predictors of six-minute walk distance in this age group. The authors also suggested that the greater proportion of the variability in six-minute walk distance might be explained by other factors such as mood, attitude, motivation and race which had also been shown to influence six-minute walk distance (17).

In 2006, Yeunyongchaiwat et al evaluated the standardized six-minute walk test in 159 healthy Thai elderly (36 males, 123 females), aged between 60 to 80 years. They established reference equation for prediction of the total distance walked during six-minute walk distance for these populations. The results showed that the average walking distance in male was 559.63±83.89 m., and in female was 484.00±76.19 m. The reference equations is $431.47 + (4.33*height_{cm.}) – (6.02*age) – (2.44*weight_{kg.}) – (58.99*sex_{(male = 0, female = 1)})$. This study found significant correlation between six-minute walk distance from the results and the predicted value using the equations proposed by Enrights, Troosters and Gibbon (r=0.550, r=0.603, r=0.510). The authors suggested that their reference equation could be utilized to predict the distance walk in healthy elderly 60-80 years (49). The factors that might influence the six-minute walk distance i.e., such as the health status, smoking history, self-reported physical activity including habitual walking were found to have relationship with the six-minute walk distance.

There were two studies which determined the six-minute walk test in the asian population and found the different values of six-minute walk distance from caucasian. However, the studies in Asian population have never shown the correlation between walking distance and other influencing domains such as muscle strength, balance and quality of life. Therefore, the purpose of the present study is to investigate whether variables known to affect exercise capacity such as muscle strength, balance, physical activity level and quality of life, as well as anthropometric variables influencing the performance of the six-minute walk test in Thai healthy elderly subjects. Furthermore, it is the intention to predict walking distance in such subjects in order to improve the interpretation of the data obtained from the six-minute walk test for an individual Thai elder.

CHAPTER III
MATERIALS AND METHODS

3.1 Subjects

Subjects were healthy males and females, aged between 60 to 80 years from elderly club in Bangkok. All volunteers were interviewed to confirm the inclusion and exclusion criteria. Subjects were informed about the study procedure and were asked to sign the informed consent prior to participating the study.

3.1.1 Inclusion criteria

Healthy elders aged 60 to 80 years from elderly clubs in Bangkok.

3.1.2 Exclusion criteria

- Having any history of cardiopulmonary condition such as heart attack, angioplasty or heart surgery within the past three months.
- Chest pain during resting or exertion within the past four weeks.
- Blood pressure higher than 150/100 mmHg or lower than 90/60 mmHg at resting.
- Abnormal pulmonary function (FEV_1 < 80 % or FEV_1/ FVC < 70 %).
- Oxygen saturation less than 90 % at resting.
- Heart rate lower than 50 bpm or higher than 100 bpm at resting.
- Having any history of neuromuscular condition likely to affect the ability of walking.
- Use of any assistance either device or person for walking.

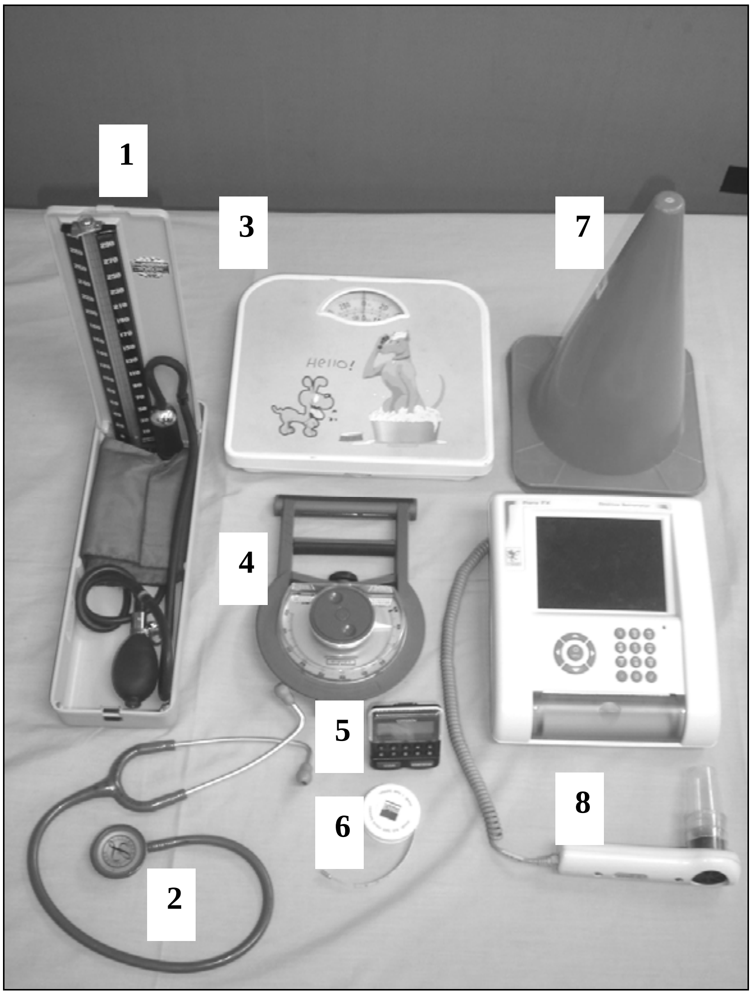
3.2 Design of the study

This study was an observational study. The data collection was performed in a cross-sectional manner.

3.3 Instrumentations

The following materials were used in the present study:

1. Walk way : 30 meters distance
2. Two cones to mark the turnaround points
3. Stop watch
4. Polar heart rate monitor (Polar Electroseries 5810, Kempele, Finland)
5. Stethoscope
6. Spirometer
7. Bathroom scale
8. Height scale
9. Safety belt
10. Dynamometer
11. Blood pressure meter
12. Flexible tape
13. Data collection form
14. Quality of life questionnaire (SF-36)
15. Physical Activity questionnaire
16. Borg scale



1. Blood pressure meter
2. Stethoscope
3. Bathroom scale
4. Hand grip dynamometer
5. Stop watch
6. Flexible tape
7. Cone
8. Spirometer

Figure 3.1 Instruments.

3.4 Procedure

The researcher performed physical examination to screen the subjects according to the exclusion criteria set i.e. blood pressure, heart rate, and pulmonary function test. The volunteer who did not have any exclusion criteria received the explanation about the procedures, then read and signed a consent form. The subjects then followed these procedures:

3.4.1 The interview session

The participants were interviewed about general health status and medical history such as age, sex, height, weight, medication, physical activity and quality of life level (see appendix B, C). For measuring physical activity level, this study used the 8- item ordinal scale with ranks of 1 to 4 for each item. A score 16 or below was the indicator of inactive. The range of 17-23 indicated moderately active and 24 or above indicated active persons. For quality of life, the SF-36 quality of life questionnaire was used. The questionnaire consisted of 36 items that cover 9 domains of quality of life including physical function, role limitations due to physical problems, social functioning, body pain, general mental health (psychological distress and psychological well-being), role limitation due to emotional problems, vitality (energy/fatigue), and general health perceptions.

3.4.2 The pulmonary function test

After the interview session, the subject was tested the pulmonary function with spirometer (Pony FX pulmonary function). The pulmonary function data included force vital capacity (FVC), force expiratory in one second (FEV_1) and ratio of FEV_1/ FVC. The subject was explained the procedure about pulmonary function test. Then, he or she sat comfortably, wearing a noseclip. He or she was instructed to breath at rest for sometime, then, performed a maximal inspiration, and then maximal forced, exhaled through the mouth piece. The test was performed 3 times with at least 1 minute of rest period. The maximal value was recorded. The normal lung function was $FEV_1 < 80$ %, FEV_1/ FVC < 70 % (50). The subjects who did not have normal pulmonary function were excluded form the study.

Figure 3.2 Pulmonary functional test.

3.4.3 Leg length

The subject was measured the leg lengths in a standard standing position i.e. standing upright with legs spreading of shoulder width, feet in neutral. The leg length was measured with flexible tape from the greater trochanter of the femur to the lateral border of the calcaneum. The average data of left and right sides was used in the data analysis (18).

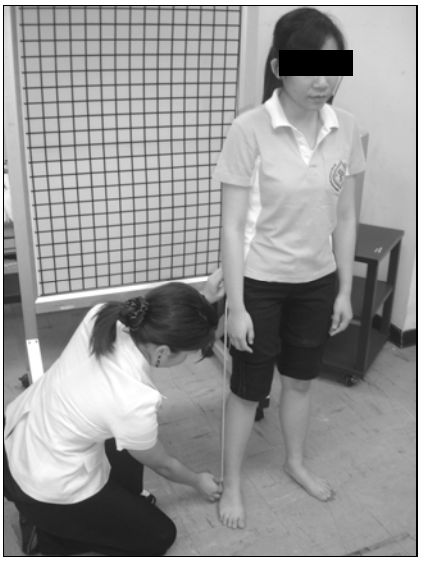


Figure 3.3 Leg length measurement.

3.4.4 Handgrip

In order to perform the handgrip strength test, subjects was on a chair and hold the dynamometer close to their body with the arm vertical and squeeze the grip with maximal force. Grip strength was measured three times for the dominant hand. The maximal value was used in the analysis (7).

Figure 3.4 Hand grip strength.

3.4.5 Balance test

The functional reach test was the test that evaluated the balance ability. The subject was asked to stand comfortably, to make a fist, and to raise their arm until it was in parallel to the yardstick. Then, the subject was instructed, “Reach forward as far as you can without taking a step”. The position of the end of the third metacarpal was recorded. Each subject performed 3 trials, one for practice, and the other two were resulted as the average value for statistical analysis (35-37).

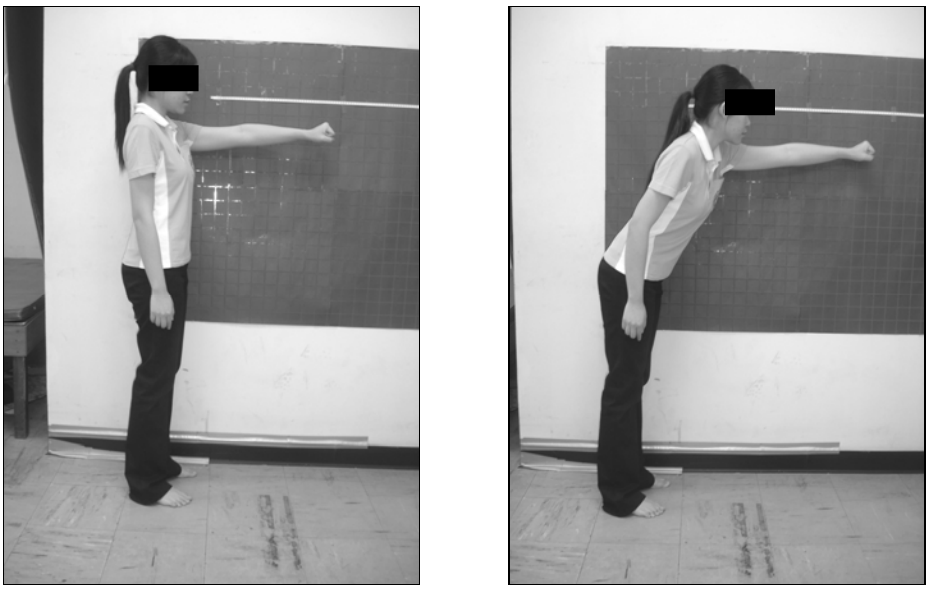


Figure 3.5 Functional reach test.

3.4.6 Six-minute walk test

To perform the six-minute walk test, subjects was recommended to "Walk as quickly as you can for six minutes so that you cover as much ground as possible". The walk way was 30 meters in length. At each end of the walk way was a cone to mark the turning point. Subjects were instructed that they could slow down or rest if necessary. Every minute, subjects were given the feedback with the standardized statements such as "you're doing well, keep it up" and "do your best" and feedback on the elapsed time. Before and after the test, heart rate, respiratory rate, oxygen saturation and rating of perceived exertion Borg scale were measured. The heart rate and respiratory rate were also measured every minute. The walk distance in six minutes was recorded for the analysis (8, 9).

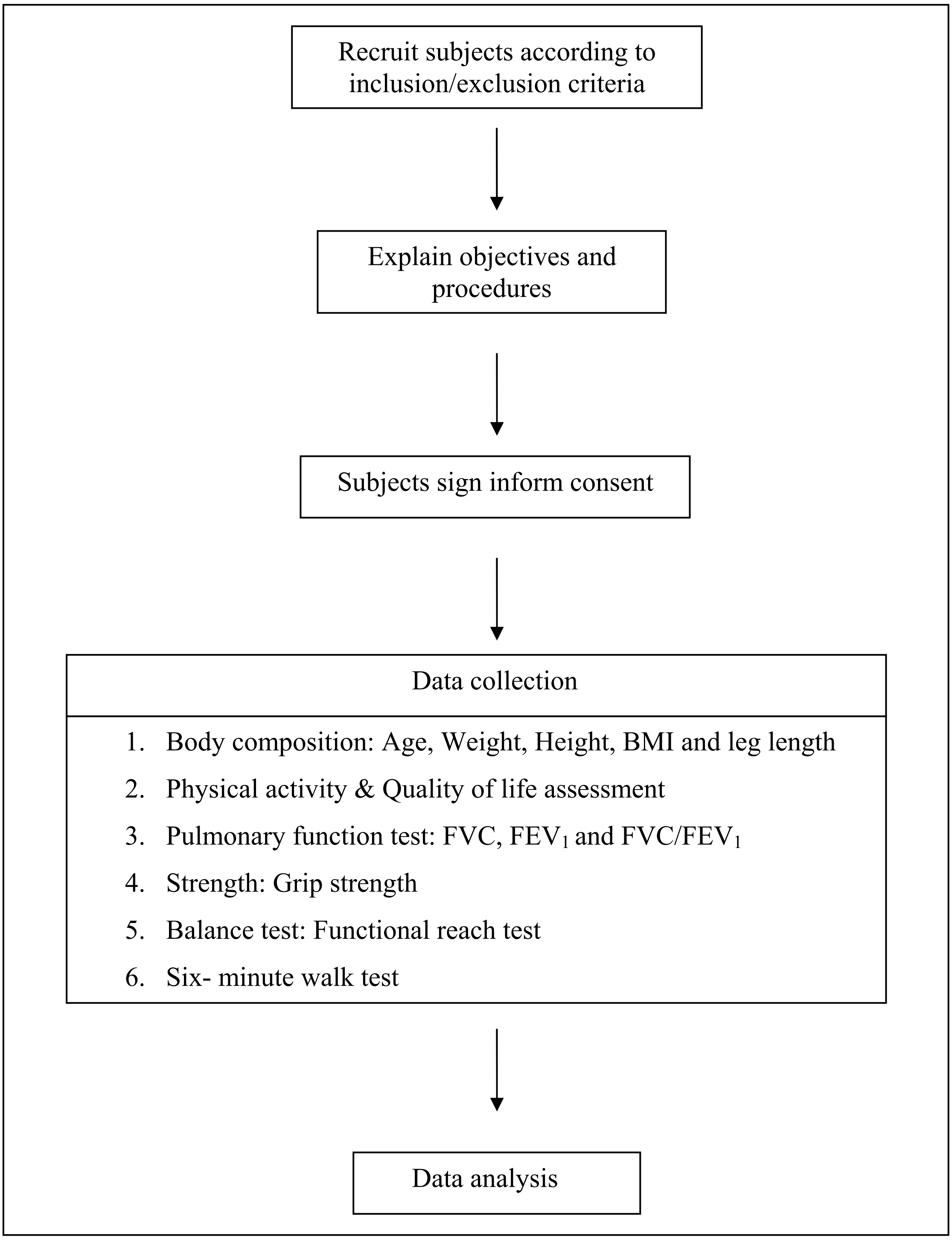


Figure 3.6 Procedure of the study.

3.5 Data Analyses

Demographic data was analyzed using descriptive statistics. Relationships of six-minute walk distance and variables of body composition, pulmonary function test, balance, physical activity and quality of life were determined by the correlation statistics. If the data were normal or non-normal distribution, Pearson or Spearman correlation coefficients were used for the analyses, respectively. Significant level of the relationship was set at $p \leq 0.05$.

The forward stepwise regression analysis was also performed to determine the predictors of 6MWD. All variables were entered into the regression equation with forward method. The significant predictors were remained in the equation and the percentage of variance they were accounted for was determined.

3.6 Sample Size Calculation

The sample size of the present study was expected from the results of previous studies. There were reports of the relationships of six minute walk distance and height, and FEV_1 (17). The correlation coefficient (r) were 0.54 and 0.48 respectively.

Power of analysis was set at 80 %, the expected sample size of the present study was approximately 37. However, the present study also aimed to investigate the distance walked from Thai elders, to identify the factors that influence of six-minute walk distance and to establish reference equations for prediction of the total distance walked during six-minutes for elderly. Thus, expected sample size was 150 subjects.

CHAPTER IV
RESULTS

The data collection included the questionnaires of personal information, physical activity, and SF-36 to assess the quality of life. Other tests were physical examination, leg length measurement, hand grip strength test, functional reach test, pulmonary function test and six-minute walk test. All participants completed all measurements of the study.

4.1 Demographic Characteristics of the Subjects

The characteristics of the 150 subjects are presented in Table 4.1. The mean age was 70, range 60-80. Subjects were measured of weight, height, BMI and leg length. Other information gathered were marital status, occupation and physical activity level.

Table 4.1 Demographic characteristics of the participants

Characteristics	**Mean±SD (range) or number/ percentages**
Males/females	12/138
Age (years)	70.06±5.81 (60-90)
Weight (kg)	57.89±9.57 (35-90)
Height (cm)	154.16±6.32 (140-178)
BMI (kg/m^2)	24.3±3.6 (16.0-35.6)
Leg length (cm)	80.63±8.61 (66-102)
Marital status	
- Married	77 (51.3%)
- Single	25 (16.7%)
- Widowed	46 (30.7%)
- Divorced	2 (1.3%)

Table 4.1 Demographic characteristics of the participants (Continued)

Characteristics	Mean±SD (range) or number/ percentages
Occupation	
Housekeeper	100 (66.7%)
Retired government officer	46 (30.7%)
Others	2 (2.6%)
Physical activity level	
Inactive	2 (1.3%)
Moderately active	75 (50%)
Active	73 (48.7%)

4.2 Health Status of the Subjects

The participants were interviewed about general health status and medical history. The numbers of aging who had hypertension and diabetes mellitus were 67 (44.7%) and 30 (20%) respectively. More than half of the subjects reported to have musculoskeletal problems, i.e., knee osteoarthritis and osteoporosis. More than half of the subjects (59.3%) regularly took medications for controlling the levels of blood pressure, and/or blood sugar, and/or maintaining the bone density. The details of health status of 150 participants are shown in Table 4.2.

Table 4.2 Health status of the 150 participants

Health status	Number(Percentages)
HT	67 (44.7%)
DM	30 (20%)
Musculoskeletal problems	65 (53.4%)
- OA Knee	46 (30.7%)
- Osteoporosis	19 (12.7%)
Medication	89 (59.3%)

Table 4.2 Health status of the 150 participants (Continued)

Health status	Number (Percentages)
Surgical history	54 (56%)
- Gynecology	36 (24%)
- Hip, knee arthroplasty	6 (4%)
- etc.	12 (8%)

4.3 Physical examination

The outcomes of physical examination were described using descriptive statistics. Table 4.3 summarizes these data.

Table 4.3 Outcomes of physical examination

Outcomes	Mean±SD (range) or number/ percentages
Hand grip strength (kg.)	22.30±5.25 (11-40.9)
Functional reach (inch)	10.87±2.17 (4-15)
Pulmonary function test variables	
FVC(l)	1.97±0.46 (1.22-3.64)
FEV_1(l)	1.66±0.39 (0.92-3.06)
FEV_1/ FVC (%)	83.98±6.27 (70-98)
SF-36 Quality of life scores	
Physical functioning	76.06±18.51 (25-100)
Role-Physical	79.33±34.24 (0-100)
Bodily Pain	67.34±16.64 (22-90)
General Health	60.17±15.68 (15-92)
Vitality	66.4±15.19 (20-100)
Social Functioning	85.58±18.07 (37.5-100)
Role-Emotional	77.78±38.36 (0-100)
Mental Health	78.78±14014 (28-100)

Table 4.3 Outcomes of physical examination (Continued)

Outcomes	Mean±SD (range) or Number (percentages)
Reported Health Transition	
Much better now than one year ago	7 (40.7%)
Somewhat better now than one year ago	21 (14%)
About the same	81(54%)
Somewhat worse now than one year ago	41 (27.3%)
Much worse than one year ago	0 (0%)
Six-minute walk distance (m.)	434 (240-638)

4.4 Associations of six-minute walk distance and other variables

Table 4.4 and Figures 4.1 - 4.10 show the associations between 6MWD and other variables. There was a significant inverse relationship between 6MWD and age, BMI and height. Significant direct relationships were found between 6MWD and functional reach test (r=0.63, p<0.01), hand grip strength, FVC, FEV_1, physical functioning part of SF-36.

Table 4.4 Correlation coefficients (r) for 6MWD and subject variables

Subject variables	6MWD (m)	*p*-value
Age (years)	-0.390**	< 0.01
Weight (kg.)	-0.076**	NS
Height (cm.)	0.196**	< 0.05
BMI (kg/m^2)	-0.215*	< 0.01
Leg length (cm.)	0.158**	NS
Physical activity level	0.016**	NS
Hand grip strength (kg.)	0.447**	< 0.01
Functional reach (inch)	0.630*	< 0.01

Table 4.4 Correlation coefficients (r) of 6MWD and subject variables (Continued)

Subject variables	**6MWD (m)**	***p*-value**
FVC(l)	0.429*	< 0.01
FEV_1(l)	0.417*	< 0.01
FEV_1/ FVC (%)	-0.074*	NS
SF36 _Physical functioning	0.319**	< 0.01
SF36_Role-Physical	0.035**	NS
SF36_Bodily Pain	0.048**	NS
SF36_General Health	0.186*	< 0.05
SF36_Vitality	0.174*	< 0.05
SF36_Social Functioning	-0.013**	NS
SF36_Role-Emotional	0.038**	NS
SF36_Mental Health	-0.142*	NS

NS: not significant at $p < 0.05$

* Pearson correlation coefficients

** Spearman correlation coefficients

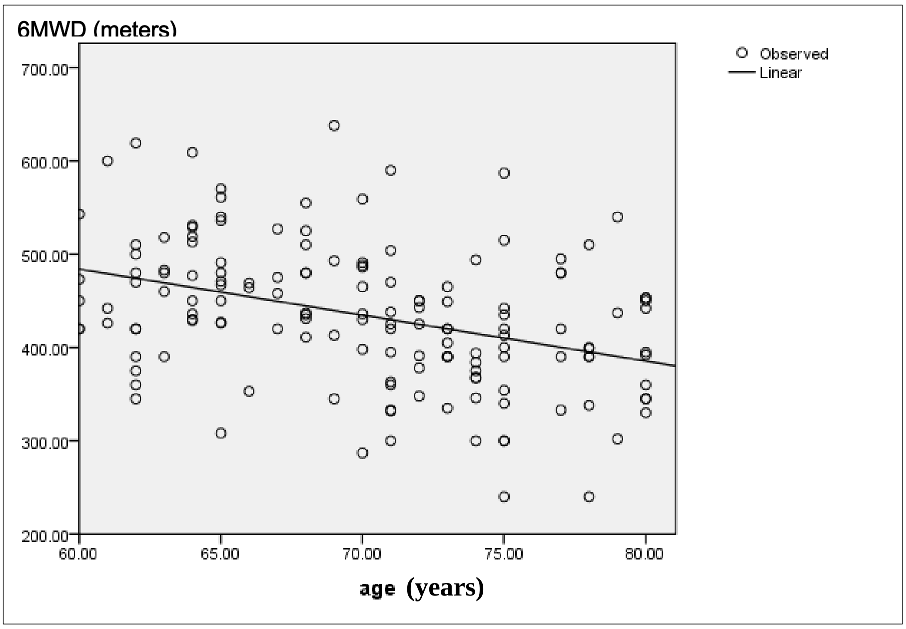


Figure 4.1 Scatter plot of six-minute walk distance and age. Line of identify is shown.

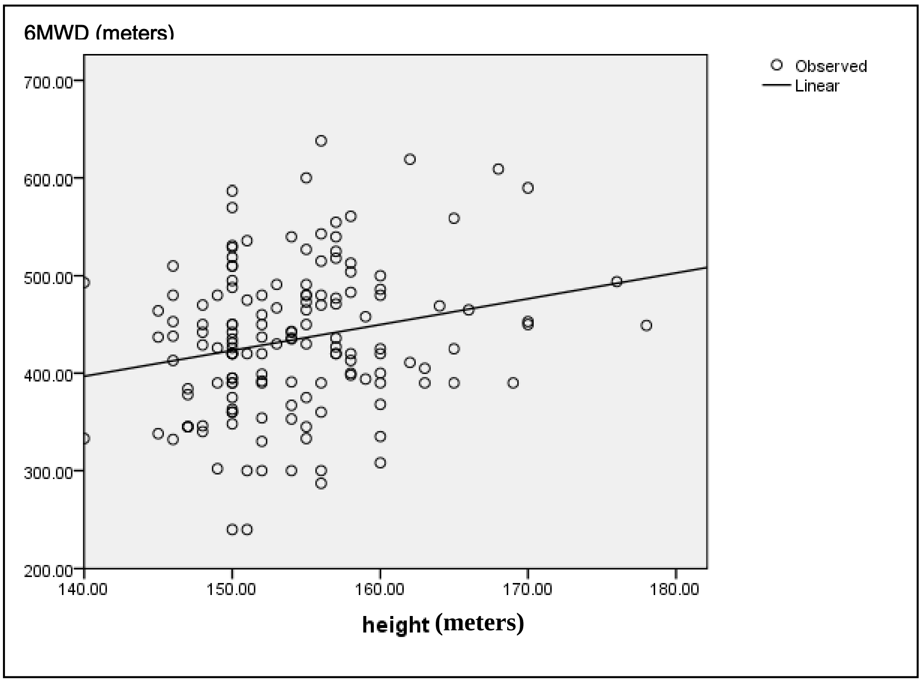


Figure 4.2 Scatter plot of six-minute walk distance and height. Line of identify is shown.

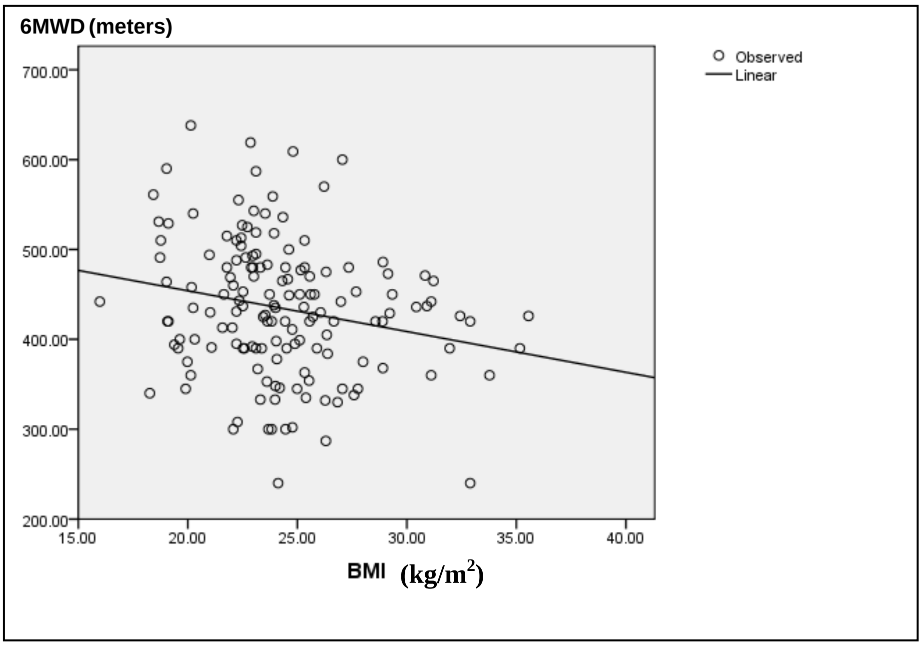


Figure 4.3 Scatter plot of six-minute walk distance and BMI. Line of identify is shown.

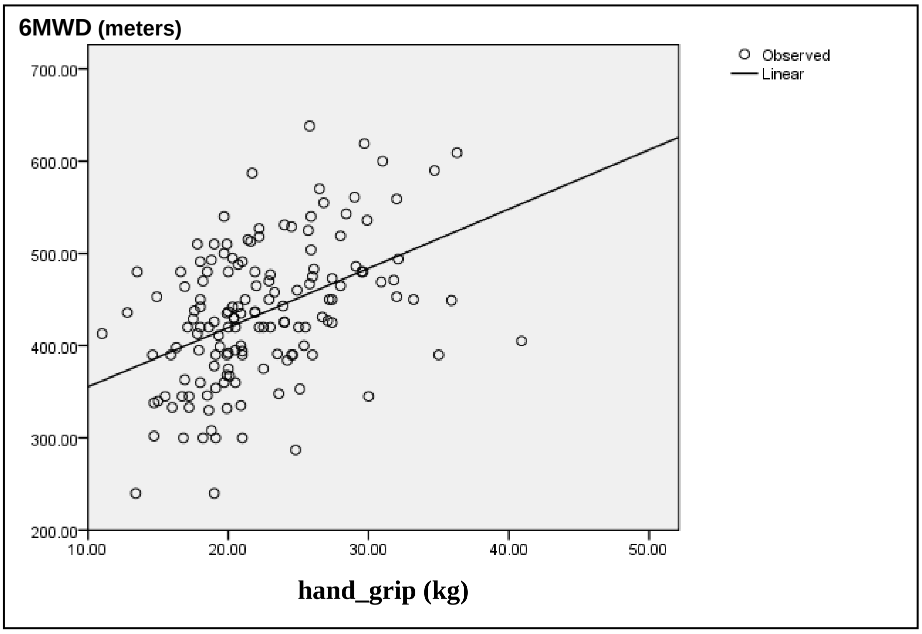


Figure 4.4 Scatter plot of six-minute walk distance and hand grip strength. Line of identify is shown.

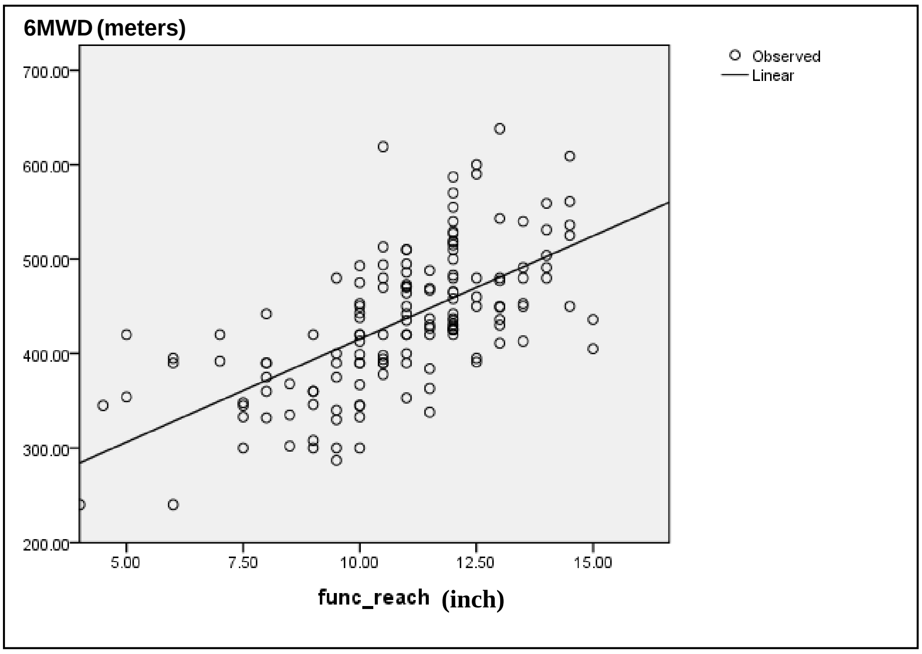


Figure 4.5 Scatter plot of six-minute walk distance and functional reach distance. Line of identify is shown.

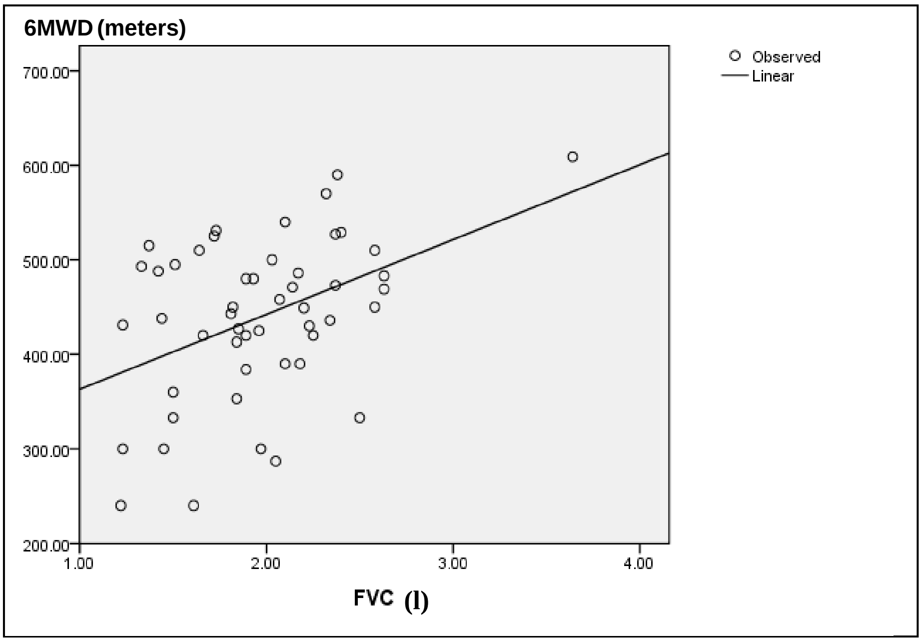


Figure 4.6 Scatter plot of six-minute walk distance and FVC. Line of identify is shown.

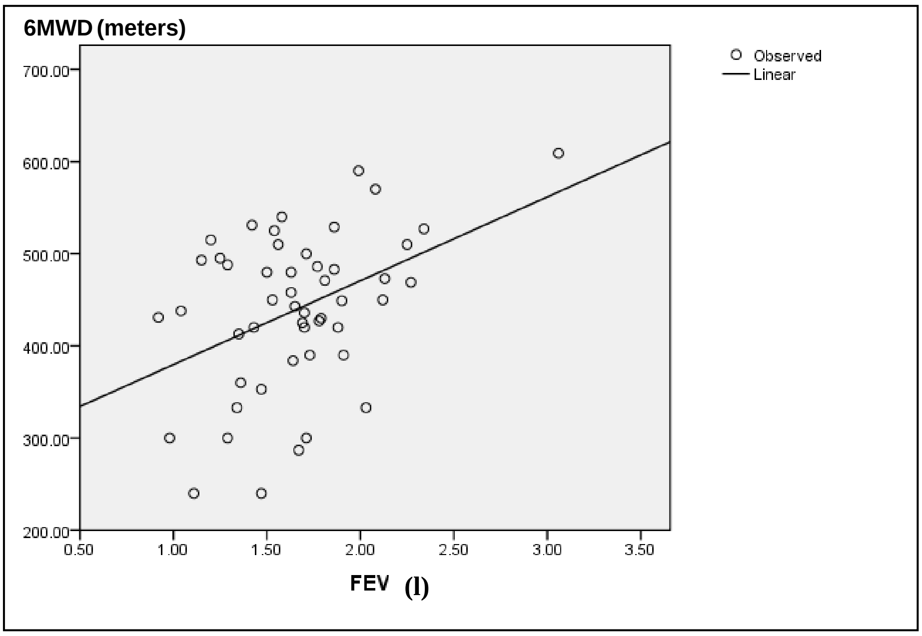


Figure 4.7 Scatter plot of six-minute walk distance and FEV_1. Line of identify is shown.

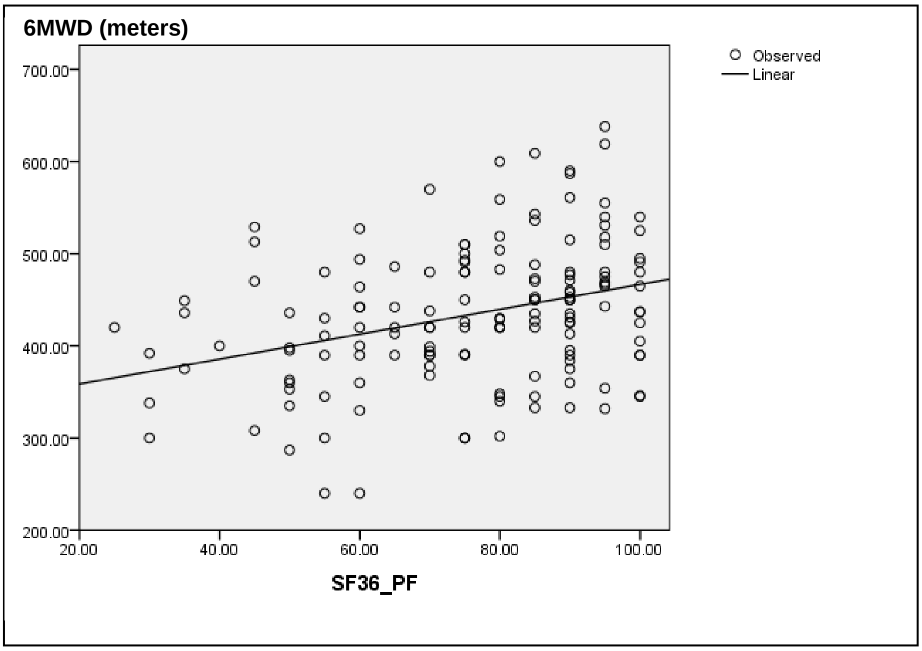


Figure 4.8 Scatter plot of six-minute walk distance and SF-36 Physical functioning. Line of identify is shown.

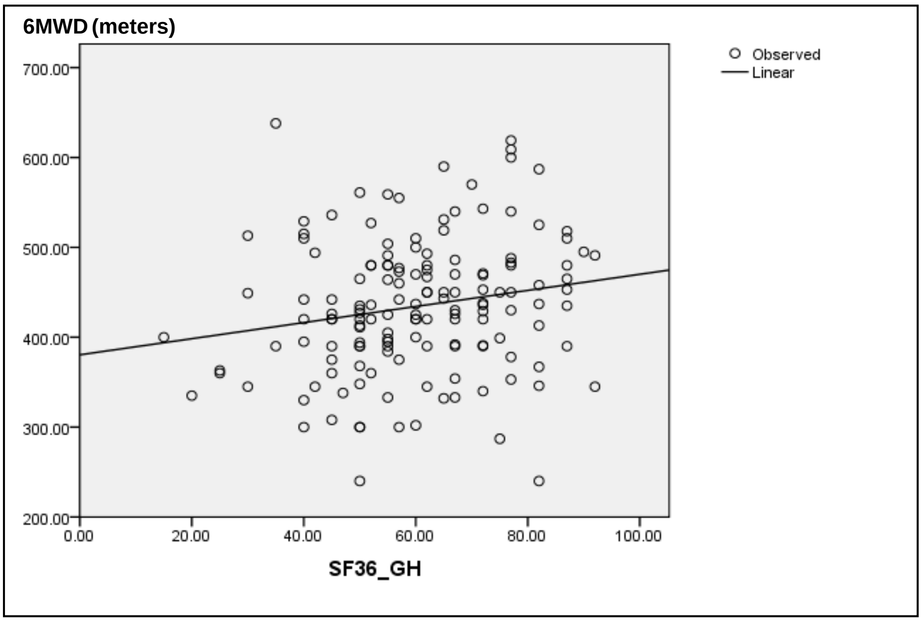


Figure 4.9 Scatter plot of six-minute walk distance and SF-36 General Health. Line of identify is shown.

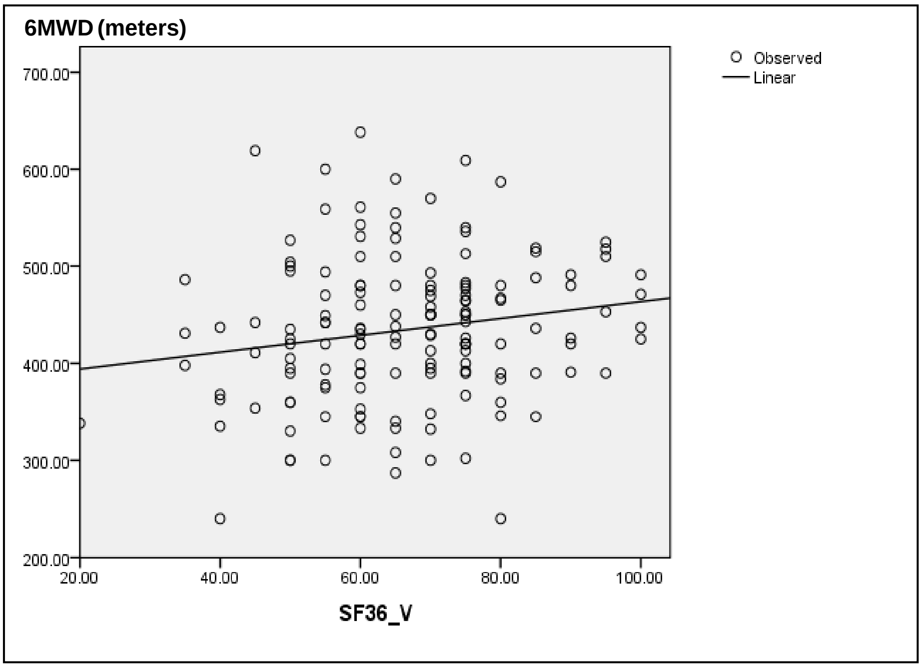


Figure 4.10 Scatter plot of six-minute walk distance and SF-36 Vitality. Line of identify is shown.

4.5 Predictors of six-minute walk distance

Forward stepwise multiple regression analysis revealed that Functional reach distance, SF-36 Physical Functioning score and FEV_1 were the significant independent predictors ($p < 0.05$). All of these variables explained 54 % of the variability in 6MWD. The regression equation of this relationship is:

6MWD (m) = 40.008+ 20.581(Functional reach distance, inch) + 1.103(SF-36 Physical Functioning, score) + 54.94 (FEV_1, l)

Functional reach distance alone accounted 46 % of the variance, while SF-36 Physical Functioning and FEV_1 explained an additional 8 % of the variance in 6MWD.

CHAPTER V
DISCUSSION

The objective to determine the distance walked in Thai healthy elder population based sample was fulfilled. All participants can safely perform the 6MWT to measure their functional status. The 6MWT presents several advantages for evaluation of the exercise capacity in elderly people because it is easy to administer, better tolerated, and reflective to the activities of daily living. The present study showed that the average 6MWD performed by the healthy Thai elderly aged 60-80 years was 434 m., with a range of 240-638 m. Among variables observed, the functional reach distance, SF-36 Physical Functioning and FEV_1 were the significant predictors of 6MWD using stepwise regression analysis.

5.1 Correlations of 6MWD with the anthropometric variables

Age, height and BMI were independently associated with the distance walked in this analysis. The observed association between age and 6MWD is consistent with the results of the previous studies (7, 9, 18). The strength declines progressively after age 50 and the reduction in muscle mass and strength are the major setbacks of normal aging. This decline might lead to the significant changes of the functional capacity (51).

BMI is a clinically useful index of obesity. In this study, the inverse relationship between BMI and 6MWD was found. Because obesity increases the workload for a given amount of exercise, this probably resulted in the shorter distance walked in participants with a higher body weight or BMI.

The relationship between height and 6MWD was also found in this study. This result was similar to ones reported by other four studies (9, 10, 18, 47). It could be postulated that a taller height was associated with a longer stride, which made longer walk distance. However, this study did not show the relationship between leg length and 6MWD. This result was similar to the report of Camarri et al (17) but contrast to one by Poh et al (18). The narrower range of leg length in this study might be the reason of the failure to show a relationship between leg length and 6MWD.

The correlation about weight and 6MWD was not found in this study. This finding was similar to the results of the study by Gibbons et al (47) but contrast to the results of the study by Trooster et al and Enright et al (9, 10). The difference of subject characteristics among studies might be the factor influencing this result.

5.2 Correlations of 6MWD with musculoskeletal variables

The muscle strength is a critical component of walking ability (51), therefore in this study, a significant positive correlations was found between 6MWD with grip strength. Hand-grip strength is not only a direct measure of skeletal muscle strength of the hands, but also an index of overall muscle strength, endurance, and disability (52). Kallman reported a strong correlation between grip strength with muscle mass. Additionally, grip strength was found to be more strongly correlated with age than muscle mass (53). Monique et al also found high correlations between hand grip strength, isometric knee extensor strength and explosive knee extensor power. Because grip strength, other than being inexpensive and easy to measure, is associated with current and future physical functioning, morbility, and mortality. Therefore, the grip strength assessment is a widespread application in clinical care (3).

The cross-sectional and longitudinal studies showed that muscle strength in adult declines with increasing age in both men and women (51). In three studies, a reduction in muscle strength and power was found to be associated with a reduced function in various activities of daily living (54-56).

However, hand-grip strength was not found to be the predictor of 6MWD in the regression analysis of this study. Enright et al found that grip strength was an independent predictor of 6MWD in their models for both women and men (7). The results indicated that muscle strength was an important factor to improve gait performance. They also suggested that the decreased grip strength and shorter 6MWD might be the useful indicators of subclinical fragility or disability in older populations.

5.3 Correlation of 6MWD with the pulmonary function test variables

Changes in the exercise capacity can be due to multiple factors, including lung function, cardiac status, respiratory muscle strength, and skeletal muscle strength. For the lung function, changes in FVC and FEV_1 have been used to assess the extent and progression of disease and the response to therapy (57). FEV_1 is not only changed due to obstructive lung disease such as COPD and asthma, but is also reduced in diseases restricting lung volumes. Previous investigators used the 6MWD as a measure of the severity of COPD and an outcome measure in COPD treatment studies (8, 58). Significant correlation between 6MWD and FEV_1 has been shown in other two studies involving patients with chronic pulmonary disease, especially cystic fibrosis (59, 60). Furthermore Baughman et al observed a decrease in the 6MWD in the majority of the sarcoidosis patients (57). In their study, factors that were significantly correlated with reduced 6MWD included FVC, oxygen saturation with exercise, and self-reported respiratory health. Alhamd showed that FEV_1%, FVC% were associated with reduced 6MWD in patients with pulmonary sarcoidosis (61).

In this study, FVC and FEV_1 in healthy elderly aged 60-80 years were significantly correlated with 6MWD. Moreover, FEV_1 was an independent predictor of 6MWD. For the elderly subjects, Enright et al found that a lower FEV_1 was a strong, independent predictor of a lower 6MWD and also associated with gait speed and grip strength in the elderly women. The possible reason is that ventilation and diffusion are the important components of respiratory system which loss efficiency with age. These factors might affect the ability to perform many tasks in ageing such as walking ability. This result is similar to the report by Camarri et al which demonstrated a positive association between FEV_1 and distance walked on the 6MWT in healthy subjects aged 55-75 years (17). However, it should be concerned that even elders with normal pulmonary function might still have impaired exercise testing (57) .

5.4 Correlation of 6MWD with balance variable

Elderly people who have problems in gait and balance usually experience difficulty in the activities of daily living (ADL). The maintenance of postural control is very important for performing the daily activities of living, especially in this population.

Functional reach test is a test of balance measuring the furthest distance a person can reach forward while standing and not taking a step. It is a simple way to measure balance impairment, change in balance performance over time, and in the design of modified environment for impaired older persons. Moreover the functional reach has been shown to correlate with balance and to predict falls in the elderly (62).

In this study, a moderate correlation between functional reach test and 6MWD was found. The possible reason for this result was the age-related decline in spinal flexibility. The decreased available spinal motion associated with the reduced reach distance demonstrating in elders (63). Thursson and Harris (64), who studied elderly subjects during ambulation, reported that the movements of the pelvis and spine in the sagittal plane and the movement of the pelvis in the transverse plane were decreased with age. The diminished reach distance was associated with an increased risk for falls and frailty in older adults (65) and during fast walking, the forward-backward movement of the trunk increased linearly from 6° to 13°. This reason supported that in older adults who had good postural stability represented by longer functional reach distance had more self-confidence to preserve walking ability so they would produce longer 6MWD. The maintenance of normal posture is essential to preserve walking ability in elderly.

Gabell and Nayak published one of few studies measuring balance while walking in young adults compared with older adults. They concluded that pathology rather than chronologic age was the main cause of postural instability during gait (66). Forward gait in elderly persons serves as stabilizing adaptations related to balance control (67). Fast walking challenges balance because it requires rapid postural responses to control the increased accelerations acting on the body. Turning is also associated with increased risk of falling in elderly adults. Shkuratova et al found that healthy older people selected strategies that maximized stability when balance was perturbed during dynamic motor tasks. When instructed to walk quickly, healthy older adults were able to increase their gait speed and stride length considerably and to decrease their double-limb support duration (68).

5.5 Correlation with other variables

Ambulation or the ability to "walk" is one of the most critical aspects of mobility and is important in order to maintain a healthy lifestyle and a good quality of life (69). There are many assessment tools to evaluate quality of life. The SF-36 is one of the most widely used scales. The SF-36 explores eight dimensions of the quality of life, "physical function", " physical role", "bodily pain", "general health", "vitality", "social function", "emotional role" and "mental health". All scales were linearly transformed to 0-100 scoring, with 100 indicating the most favorable health state and 0 indicating the least favorable health state. Juenger et al indicated that quality of life is greatly impaired in congestive heart failure. All SF-36 scales decreased with NYHA functional class. In addition, patients with a more severe impairment of functional capacity as assessed by the six-minute walk test and peak oxygen uptake had in general significantly lower SF-36 values (70).

This study used the SF-36 to evaluate the relationship between quality of life and 6MWD in healthy elderly. The significant correlations of SF-36 Physical Functioning scale, General Health scale, Vitality scale and 6MWD was found. However, the other domains of the SF-36 including role-physical functioning, bodily pain, social functioning, role-emotional and mental health were not correlated with 6MWD. Furthermore, the SF-36 physical functioning scale was the independent predictor of 6MWD. It can be explained that the SF-36 physical functioning scale which assess whether the participant's health limits ability to perform vigorous activities. The results from previous studies showed that individuals with congestive heart failure, chronic lung diseases, and arthritis had decreased SF-36 physical functioning score. Therefore, a change in this score is considered clinically significant and correlates with health outcomes and mortality (71). The average decreases in SF-

36 physical functioning score was also associated with muscle weakness, pain and shortness of breath at rest (72). For the same reason, the corresponding of SF-36 Physical Functioning in healthy aging was found to be the factor that related to quality of walking in 6MWT better than other parts of the questionnaire.

For the physical activity, the majority of subjects reported moderate physical activity level and no significant correlations were found between physical activity level and 6MWD. This finding was consistent with other two studies (18, 47). In this study the physical activity was assessed by a questionnaire consisted of 8 items. The sensitivity of this questionnaire to detect the physical activity in this population was uncleared. Hense a suitable tool to estimate the physical activity level in healthy elderly is still needed to be proposed. Also, greater variability of the physical might be needed to determine if there is any correlation.

5.6 The values and the reference equations of 6MWD

Many authors have described different reference equations and tables to predict the 6MWD in healthy elderly subjects. For this study, the mean 6MWD in the healthy participants was 434 m. The results showed remarkable closing to the report by Yeanyongchaiwat et al in 159 healthy Thai elderly 60-80 years but less than the predicted 6MWD from regression equations derived in Caucasian populations (19). One possible reason for the lower 6MWD in Thai elders may be the differences in body composition when compared with caucasians. This explanation is supported by Poh et al who studied six-minute walk test distance in healthy Singaporean adults. They explained that singaporean asians having a higher percentage of body fat for a given BMI compared to the caucasians while lean body mass is a predictor of exercise capacity in healthy subjects (18). Other causes may include differences in the speed of habitual walking and walking efficiency between caucasians and asians.

When comparing the mean 6MWD of Thai from this study with the mean 6MWD of Singaporean, the results showed that Thai participants had lower 6MWD than the Singaporeans. However in the study by Poh et al, they had only 32 Chinese participants aged between 45 and 85 years. The small sample size and the greater range of age may be the factors that influenced the results.

About the reference equations, the previous studies show that height, sex, age and weight were the dependent variables of 6MWD (9, 19). However, this study is the first report that found the correlation about 6MWD, Functional reach test and SF-36 quality of life score. The results showed that these two factors being statistically significant predictors of 6MWD in this Thai healthy aging group. The possible explanation may be that most participants in this study were female which had similar anthropometric characteristics so the factor was not various enough to influenced the 6MWD. However, the reference equation of this study can be generalized to the elders who have ability to walk more than 200 meters in 6 minutes.

For FEV_1, it was a predictor of 6MWD in this study similar to the reported by Camarri et al and Webb et al which recently found an association between FEV_1 and the distance walked on the incremental shuttle walking test in healthy males (17, 73). The reference equation in this study suggested that these factors should be considered when comparing the 6MWD of an individual patient to healthy elderly person.

5.7 Limitations of study

There are some major limitations of this study. First, the study population might not be large enough to determine normal values. Therefore, the generalization to the population of Thai elderly may need to be done with caution.

Second, the participants in this study were the urban older adults from the aging club which regularly exercised. Therefore, the physical performance in this population may be higher than typical community-dwelling older people. Furthermore the majority of subjects were female. The results of this study then may apply to the only healthy female elderly who routinely have exercise activity.

Finally, it would be additional beneficial to observe the relationship between 6MWD and pulmonary functional test in all of subjects. However in this study, there were only 50 elderly who completed the pulmonary function test, because it was quite costly and complicate to administer.

5.8 Suggestion for Further Study

This study was undertaken in the urban elderly. Lifestyle and quality of life in this population may be different when compared with elderly who live in suburb or rural areas. The future study might utilize the 6MWT to measure of functional exercise capacity in people who live in other types of community.

During the interview procedure, this study did not take history of fall into account. Further studies should examine whether older people had a history of falls, because fall history in older adults might influence the self-confident of walking and gait performance. In addition, the aging who have been fall might have different leg strength, poorer balance, lower muscle mass and slower walk time that effected the 6MWD. The fall history may be one factor that correlated with 6MWD.

Moreover, this study did not have the examination process for screen the healthy elderly with abnormal posture such as throracic kyphosis, lumbar kyphosis. The elderly with these abnormal postures might show a decline in walking abilities. There is a possibility that spinal curvature is a marker for generalized musculoskeletal health such as trunk extensor weakness and excessive degenerative change is responsible for both the spinal curve and the gait characteristics. Therefore, further studies should perform the physical examination to rule out these factors in healthy elderly.

Finally, this study found that the functional reach test was the main variable that significantly correlated to 6MWD. For further studies, it would be interesting to further investigate relationship between balance and walking ability.

CHAPTER VI
CONCLUSION

The 6MWT is a useful measure of functional capacity targeted at people with chronic disease and healthy adults. This test has been widely used for preoperative and postoperative evaluation. Moreover, 6MWT has been used for measuring the response to therapeutic interventions for cardiac and pulmonary diseases.

This study was an observational study to measure the distance walk in Thai healthy population-based elderly sample and identify the factors that were related to the six-minute walk distance. One-hundred and fifty healthy Thai elderly performed the standard protocol of 6MWT, as well as answered questionnaires and performed the physical performance test including physical activities, quality of life, pulmonary function test, grip strength, and functional reach test. The results shown that 6MWD of healthy Thai elderly aged 60-80 years was close to the values reported in asian population but less than the values measured in caucasians in the previous studies. This current finding indicated that greater distance of 6MWT was related to multiple factors. The longer of 6MWD is associated with younger age, lower BMI, taller, better balance performance, higher muscle strength, more values of FVC and FEV_1, and more score of SF-36 physical functioning. A prediction equation containing functional reach distance, SF-36 physical functioning score and FEV_1 explained 54 % of the variance in 6MWD.

Therefore, rehabilitation program aimed to improve the gait performance in elderly should address the training of balance, physical functioning and pulmonary function.

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APPENDICES

APPENDIX A
PARTICIPANT INFORMATION SHEET

เอกสารชี้แจงผู้เข้าร่วมการวิจัย

ในเอกสารนี้อาจมีข้อความที่ท่านอ่านแล้วยังไม่เข้าใจ โปรดสอบถามหัวหน้าโครงการวิจัย หรือผู้แทนให้ช่วยอธิบายจนกว่าจะเข้าใจดี ท่านอาจจะขอเอกสารนี้กลับไปอ่านที่บ้านเพื่อปรึกษาหารือกับญาติพี่น้อง เพื่อนสนิท แพทย์ประจำตัวของท่าน หรือแพทย์ท่านอื่น เพื่อช่วยในการตัดสินใจเข้าร่วมการวิจัย

ชื่อโครงการ การทดสอบด้วยการเดิน 6 นาทีในคนผู้สูงอายุไทยสุขภาพดีช่วงอายุ 60-80 ปี
ชื่อผู้วิจัย นางสาวพรรณรำไพ ไทยตรง
สถานที่วิจัย คณะกายภาพบำบัดและวิทยาศาสตร์การเคลื่อนไหวประยุกต์ มหาวิทยาลัยมหิดล
ผู้ให้ทุน ไม่มี

โครงการวิจัยนี้ทำขึ้นเพื่อหาค่าปกติของการทดสอบด้วยการเดิน 6 นาทีในผู้สูงอายุไทยสุขภาพดีที่มีช่วงอายุ 60-80 ปี และศึกษาถึงปัจจัยที่เกี่ยวข้องกับระยะทางที่ได้จากการทดสอบด้วยการเดิน 6 นาที ซึ่งประโยชน์ที่คาดว่าจะได้รับคือ ทำให้ทราบข้อมูลในกลุ่มผู้สูงอายุไทยสุขภาพดีที่มีช่วงอายุ 60-80 ปี ในการทำการทดสอบด้วยการเดิน 6 นาที เพื่อนำข้อมูลดังกล่าวมาใช้แปลผลให้ผู้ป่วยในช่วงอายุเดียวกันได้ชัดเจนยิ่งขึ้น ทราบปัจจัยที่มีส่วนเกี่ยวข้องกับระยะทางที่ได้จากการทดสอบด้วยการเดิน 6 นาทีและสามารถนำมาเป็นข้อมูลในการวางแผนโปรแกรมการฝึกหรือโปรแกรมการฟื้นฟูสำหรับผู้ป่วยกรณีที่ได้รับการประเมินด้วยวิธีดังกล่าว

ท่านได้รับเชิญให้เข้าร่วมการวิจัยนี้ เพราะท่านเป็นผู้ที่มีคุณสมบัติครบถ้วน ตามเกณฑ์ที่ผู้วิจัยกำหนด คือ ผู้สูงอายุไทยสุขภาพดีอายุระหว่าง 60-80 ปี

โครงการวิจัยนี้จะมีผู้เข้าร่วมการวิจัยทั้งสิ้น 300 คน ระยะเวลาที่ใช้ในการวิจัยเดือนสิงหาคม พ.ศ. 2551 ถึงเดือนสิงหาคม พ.ศ. 2552

เมื่อท่านเข้าร่วมการวิจัยแล้ว สิ่งที่ท่านจะต้องปฏิบัติตามขั้นตอนการดำเนินการวิจัยดังต่อไปนี้

ขั้นตอนการเตรียมการ

ผู้วิจัยจะมีการตรวจคัดกรองเพื่อคัดเลือกผู้เข้าร่วมวิจัยที่มีคุณสมบัติตามที่กำหนด โดยสอบถามเกี่ยวกับข้อมูลส่วนตัวและประวัติทางสุขภาพ ทำการวัดส่วนสูงและชั่งน้ำหนักพร้อมกับนำค่าดังกล่าวมาคำนวณหาค่า ดัชนีมวลกาย (น้ำหนัก / ส่วนสูง (เมตร^2)) มีการประเมินระดับความดันโลหิต, อัตราการเต้นของหัวใจ, ค่าออกซิเจนอิ่มตัวขณะพักรวมทั้งมีการประเมินสมรรถภาพปอด

ประเมินสมรรถภาพปอด โดยใช้เครื่องมือทดสอบสมรรถภาพปอด โดยเริ่มต้นจากให้ผู้เข้าร่วมวิจัยนั่งพัก ผู้วิจัยจะอธิบายขั้นตอนการทดสอบให้ผู้เข้าร่วมวิจัยเข้าใจชัดเจน วิธีการทดสอบมีดังนี้ ใช้ที่บีบจมูกปิดจมูกไว้ อมท่อเป่าให้สนิทไม่มีรูรั่วและผู้ทดสอบหายใจเข้าออกธรรมดา เมื่อผู้วิจัยให้สัญญาณผู้เข้าร่วมวิจัยจึงหายใจเข้าลึกจนสุดปอดแล้วเป่าออกมาเข้าไปในเครื่องอย่างแรงและเร็ว ให้นานที่สุดเท่าที่จะทำได้อย่างน้อย 4-6 วินาที ผู้เข้าร่วมวิจัยเป่าทั้งหมด 3 ครั้ง แต่ละครั้งมีเวลาพักอย่างน้อย 1 นาที

เมื่อผู้เข้าร่วมวิจัยผ่านการคัดเลือกตามเกณฑ์ที่กำหนดจึงจะได้เข้าร่วมการวิจัย ผู้วิจัยจะอธิบายวัตถุประสงค์ ขั้นตอน ประโยชน์ของการศึกษา ความเสี่ยงในการวิจัย รวมทั้งการป้องกันและความปลอดภัยของการศึกษานี้ จากนั้นผู้เข้าร่วมการวิจัยลงนามในใบยินยอมเข้าร่วมวิจัย

ขั้นตอนการเก็บข้อมูล

ผู้เข้าร่วมการวิจัยจะได้รับการสอบถามถึงข้อมูลส่วนตัว เช่น อายุ น้ำหนัก ส่วนสูง ประวัติสุขภาพ การประเมินระดับความสามารถในการทำกิจกรรม จะใช้แบบสอบถามทั้งสิ้น 8 ข้อ โดยระดับคะแนนจะแบ่งความสามารถออกเป็น 3 ระดับ การประเมินคุณภาพชีวิตโดยใช้แบบประเมิน SF-36

<u>ข้อมูลสัดส่วนของร่างกาย</u>

ผู้เข้าร่วมการวิจัยจะถูกวัดค่าความยาวขาในขณะยืนโดยจะวัดทั้งขาข้างซ้ายและขาข้างขวา โดยใช้สายวัดวัดจากส่วนหัวของกระดูกต้นขาไปยังด้านข้างของกระดูกส้นเท้า ค่าที่ได้จากการวัดความยาวขาทั้งด้านซ้ายและขวาจะนำมาเฉลี่ยและเป็นค่าที่ใช้ในการวิเคราะห์ข้อมูลต่อไป

การวัดแรงบีบมือ

ผู้เข้าร่วมงานวิจัยจะถูกวัดค่าแรงบีบโดยใช้เครื่องวัดแรงบีบมือโดยผู้เข้าร่วมการวิจัยจะอยู่ในท่านั่งตำแหน่งของแขนอยู่แนบลำตัว ออกแรงบีบมือให้มากที่สุดเท่าที่สามารถทำได้ โดยทำการทดสอบทั้งสิ้น 3 ครั้งของมือแต่ละข้าง การเก็บข้อมูลจะเก็บจากค่าที่ผู้เข้าร่วมงานวิจัยทำได้มากที่สุดในมือข้างที่ถนัด

การทดสอบการทรงตัว

ผู้เข้าร่วมการวิจัยจะอยู่ในท่ายืนสบาย ยกแขนขึ้นระดับไหล่พร้อมทั้งกำมือ และได้รับคำสั่งให้ยื่นแขนออกไปให้ไกลที่สุดเท่าที่สามารถทำได้ โดยไม่ก้าวขา ทำทั้งสิ้น 3 ครั้ง โดยครั้งแรกเป็นการซักซ้อมความเข้าใจและจะเก็บข้อมูลจริงใน 2 ครั้งสุดท้าย โดยวัดที่ตำแหน่งข้อต่อที่ 3 ของหลังมือ ค่าที่ได้จากการวัด 2 ครั้ง จะนำมาเฉลี่ยเพื่อทำการวิเคราะห์ต่อไป

การทดสอบด้วยการเดิน 6 นาที

การทดสอบด้วยการเดิน 6 นาทีเป็นการทดสอบด้วยวิธีการเดินให้ได้ระยะทางที่มากที่สุดภายในเวลา 6 นาที สถานที่ทดสอบจากจุดเริ่มต้นถึงจุดสุดท้ายมีระยะทาง 30 เมตร โดยมีโคนรูปกรวยตั้งอยู่ ณ 2 จุดดังกล่าว ผู้เข้าร่วมการวิจัยจะได้รับคำแนะนำว่าให้เดินให้เร็วที่สุดเท่าที่จะสามารถทำได้ เพื่อให้ได้ระยะทางมากที่สุดภายในระยะเวลา 6 นาที ทั้งนี้ผู้เข้าร่วมการวิจัยจะเป็นผู้กำหนดความเร็วในการเดินด้วยตนเองและสามารถหยุดพักระหว่างการทดสอบหรือหยุดการทดสอบเมื่อไรก็ได้ที่ผู้เข้าร่วมการวิจัยต้องการ ผู้วิจัยจะทำการติดเครื่องมือเพื่อวัดอัตราการเต้นของหัวใจ อัตราการหายใจ ค่าออกซิเจนอิ่มตัวที่บริเวณใต้ราวนมและบริเวณปลายนิ้วมือของผู้เข้าร่วมการวิจัยเพื่อวัดค่าดังกล่าวขณะทำการทดสอบทุก ๆ นาที ในแต่ละนาทีของการทดสอบผู้วิจัยจะบอกเวลาที่เหลืออยู่และประโยคให้กำลังใจที่เหมือน ๆ กัน เช่น “ คุณทำได้ดีแล้ว” ก่อนและหลังการทดสอบ ผู้วิจัยจะบันทึก อัตราการเต้นของหัวใจ, อัตราการหายใจ, ค่าออกซิเจนอิ่มตัว, ระดับความเหนื่อยและล้าของผู้เข้าร่วมการวิจัยรวมถึงบันทึกระยะทางที่ผู้เข้าร่วมการวิจัยเดินได้ทั้งหมดในการทดสอบ

หากเกิดผลข้างเคียงที่ไม่พึงประสงค์จากการวิจัยครั้งนี้ทางคณะผู้วิจัยจะยุติการวิจัยโดยทันทีและจะให้ท่านได้รับการรักษาที่เหมาะสมต่อสภาพการณ์นั้นๆ การวิจัยในครั้งนี้มีแพทย์ที่ปรึกษาคือ นายแพทย์คุณากร สินธพพงศ์ ภาควิชากายวิภาคศาสตร์ คณะแพทยศาสตร์ ศิริราชพยาบาลเบอร์โทรศัพท์ติดต่อในกรณีฉุกเฉิน คือ 086-8233288 หรือหากผู้เข้าร่วมวิจัยมีข้อสงสัยที่

เกี่ยวกับการวิจัยสามารถติดต่อสอบถามได้ที่ นางสาวพรรณรำไพ ไทยตรง เลขที่ 198/2 อาคารสำนักงานมหาวิทยาลัยมหิดล (เดิม) ชั้น 4 ถ.เชิงสะพานพระปิ่นเกล้า แขวงบางยี่ขัน เขตบางพลัด กทม. 10700 เบอร์โทรศัพท์ 02-433-7092, 08-9223-0713 ได้ทุกเวลา

การวิจัยนี้ไม่มีค่าตอบแทนที่จะได้รับ และไม่มีค่าใช้จ่ายใด ๆ ที่ท่านจะต้องรับผิดชอบ

หากมีข้อมูลเพิ่มเติมทั้งด้านประโยชน์และโทษที่เกี่ยวข้องกับการวิจัยนี้ ผู้วิจัยจะแจ้งให้ทราบโดยรวดเร็วไม่ปิดบัง

ข้อมูลส่วนตัวของท่านจะถูกเก็บรักษาไว้ ไม่เปิดเผยต่อสาธารณะเป็นรายบุคคล แต่จะรายงานผลการวิจัยเป็นข้อมูลส่วนรวม ข้อมูลของท่านเป็นรายบุคคลอาจมีคณะบุคคลบางกลุ่มเข้ามาตรวจสอบได้ เช่น ผู้ให้ทุนวิจัย สถาบันหรือองค์กรของรัฐที่มีหน้าที่ตรวจสอบ คณะกรรมการจริยธรรมฯ เป็นต้น

ท่านมีสิทธิ์ถอนตัวออกจากโครงการการวิจัยเมื่อใดก็ได้ โดยไม่ต้องแจ้งให้ทราบล่วงหน้าและการไม่เข้าร่วมการวิจัยหรือถอนตัวออกจากโครงการวิจัยนี้จะไม่มีผลกระทบต่อการบริการและการรักษาที่ สมควรจะได้รับแต่ประการใด

โครงการวิจัยนี้ได้รับการพิจารณารับรองจากคณะกรรมการจริยธรรมการวิจัยในคนของมหาวิทยาลัยมหิดล ซึ่งมีสำนักงานอยู่ที่ สำนักงานอธิการบดีมหาวิทยาลัยมหิดล เลขที่ 999 ถนนพุทธมณฑล สาย 4 ตำบลศาลายา อำเภอพุทธมณฑล จังหวัดนครปฐม 73170 หมายเลขโทรศัพท์ 02-849-6223-5 โทรสาร 02-849-6223 หากท่านได้รับการปฏิบัติไม่ตรงตามที่ระบุไว้ ท่านสามารถติดต่อกับประธานคณะกรรมการฯ หรือผู้แทนได้ตามสถานที่และหมายเลขโทรศัพท์ข้างต้น

ข้าพเจ้าได้อ่านรายละเอียดในเอกสารนี้ครบถ้วนแล้ว

ลงชื่อ..ผู้เข้าร่วมวิจัย

(……………………………………)

APPENDIX B
CONSENT FORM

หนังสือแสดงเจตนายินยอมเข้าร่วมการวิจัย

การวิจัยเรื่อง: การทดสอบด้วยการเดิน 6 นาที ในผู้สูงอายุไทยสุขภาพดีช่วงอายุ 60-80 ปี
วันให้คำยินยอม วันที่ …………….......… เดือน ……………………… พ.ศ. …………………

ก่อนที่จะลงนามในใบยินยอมให้ทำการวิจัยนี้ ข้าพเจ้าได้รับการอธิบายจากผู้วิจัยถึงวัตถุประสงค์ของการวิจัย วิธีการวิจัย อันตราย หรืออาการที่อาจเกิดขึ้นจากการวิจัย รวมทั้งประโยชน์ที่จะเกิดขึ้นจากการวิจัยอย่างละเอียด และมีความเข้าใจดีแล้ว

ผู้วิจัยรับรองว่าจะตอบคำถามต่าง ๆ ที่ข้าพเจ้าสงสัยด้วยความเต็มใจ ไม่ปิดบังซ่อนเร้น จนข้าพเจ้าพอใจ

ข้าพเจ้ามีสิทธิที่จะบอกเลิกการเข้าร่วมโครงการวิจัยนี้เมื่อใดก็ได้ และเข้าร่วมโครงการวิจัยนี้ โดยสมัครใจ และการบอกเลิกการเข้าร่วมการวิจัยนี้ จะไม่มีผลต่อการรักษาโรคที่ข้าพเจ้าจะพึงได้รับต่อไป

ผู้วิจัยรับรองว่าจะเก็บข้อมูลเฉพาะที่เกี่ยวกับตัวข้าพเจ้าเป็นความลับ และจะเปิดเผยได้เฉพาะ ในรูปที่สรุปผลการวิจัย การเปิดเผยข้อมูลเกี่ยวกับตัวข้าพเจ้าต่อหน่วยงานต่าง ๆ ที่เกี่ยวข้องกระทำ ได้เฉพาะกรณีจำเป็นด้วยเหตุผลทางวิชาการเท่านั้น

ผู้วิจัยรับรองว่าหากเกิดอันตรายใด ๆ จากการวิจัยดังกล่าว ข้าพเจ้าจะได้รับการรักษาพยาบาล โดยไม่คิดมูลค่าตามมาตรฐานวิชาชีพ และจะได้รับการชดเชยรายได้ที่สูญเสียไประหว่างการรักษา พยาบาลดังกล่าว ตลอดจนเงินทดแทนความพิการที่อาจเกิดขึ้น

ผู้วิจัยรับรองว่าหากมีข้อมูลเพิ่มเติมที่ส่งผลกระทบต่อการวิจัย ข้าพเจ้าจะได้รับการแจ้งให้ทราบ โดยไม่ปิดบังซ่อนเร้น

ข้าพเจ้าได้อ่านข้อความข้างต้นแล้ว และมีความเข้าใจดีทุกประการ และได้ลงนามในใบยินยอม นี้ด้วยความเต็มใจ

ลงนาม .... ผู้ยินยอม

ลงนาม .... พยาน

ลงนาม .... พยาน

ในกรณีที่ผู้ยินยอมตนให้ทำการวิจัยไม่สามารถอ่านหนังสือได้ จะต้องได้รับการยินยอมในขณะ ที่ยังมีสติสัมปชัญญะ และระบุข้อความไว้ตามนี้ ข้าพเจ้าไม่สามารถอ่านหนังสือได้ แต่ผู้วิจัยได้อ่าน ข้อความในใบยินยอมนี้ให้แก่ข้าพเจ้าฟังจนเข้าใจดีแล้ว ข้าพเจ้าจึงลงนาม หรือประทับลายนิ้วแม่มือขวา ของข้าพเจ้าในใบยินยอมนี้ด้วยความเต็มใจ

ลงนาม .... ผู้ยินยอม

ลงนาม .... พยาน

ลงนาม .... พยาน

APPENDIX C
DATA COLLECTION FORM

แบบสอบถามเพื่อคัดกรองผู้เข้าร่วมวิจัย

เรื่อง "การทดสอบด้วยการเดิน 6 นาที ในผู้สูงอายุไทยสุขภาพดีช่วงอายุ 60-80 ปี"

วันที่...........เดือน................พ.ศ. ....

ชื่อ-นามสกุล...

ที่อยู่ ....

....

ตอนที่ 1 ข้อมูลทั่วไป

1. อายุ..........................ปี
2. เพศ ❒ หญิง ❒ ชาย
3. สถานภาพสมรส ❒ สมรส ❒ โสด ❒ หม้าย ❒ หย่าร้าง
4. น้ำหนัก................................กิโลกรัม
5. ส่วนสูง................................เซนติเมตร ดัชนีมวลกาย (BMI)=................ก.ก./ม.^{2}
6. อาชีพ..

ตอนที่ 2 ข้อมูลเกี่ยวกับประวัติสุขภาพ

7. ท่านป่วยเป็นโรคได้แก่ โรคหัวใจ โรคความดันโลหิตสูง โรคเบาหวาน โรคไตหรือไม่

   ❒ ไม่ใช่ ❒ ใช่ โปรดระบุ...............................เป็นมานาน..........ปี
8. ท่านป่วยเป็นโรคปอด ได้แก่ โรคหอบหืด โรคปอดอุดกั้นเรื้อรังหรือไม่

   ❒ ไม่ใช่ ❒ ใช่ โปรดระบุ...............................เป็นมานาน..........ปี
9. ท่านป่วยเป็นโรคเกี่ยวกับกระดูก ข้อต่อและกล้ามเนื้อหรือไม่

   ❒ ไม่ใช่ ❒ ใช่ โปรดระบุ...............................เป็นมานาน..........ปี

10. ท่านป่วยเป็นโรคทางระบบประสาทหรือไม่

❐ ไม่ใช่ ❐ ใช่ โปรดระบุ................................เป็นมานาน...........ปี

11. ท่านป่วยเป็นโรคสมองหรือหลอดเลือดสมองหรือไม่

❐ ไม่ใช่ ❐ ใช่ โปรดระบุ................................เป็นมานาน...........ปี

12. ท่านมีโรคประจำตัวหรือไม่

❐ ไม่มี ❐ ไม่เคยตรวจ ❐ มี โปรดระบุ................................เป็นมานาน...........ปี

13. ท่านเจ็บหน้าอก (chest pain) ในขณะพักหรือทำกิจกรรม ภายใน 4 สัปดาห์หรือไม่

❐ ไม่ใช่ ❐ ใช่

14. ท่านต้องใช้เครื่องช่วยเดินใช่หรือไม่

❐ ไม่ใช่ ❐ ใช่ โปรดระบุ............................

15. ปัจจุบันท่านต้องรับประทานยาเป็นประจำหรือไม่

❐ ไม่ใช่ ❐ ใช่ โปรดระบุชื่อยา...

……………………ระยะเวลาที่ใช้..............ปี

ประวัติการผ่าตัด (โปรดระบุจำนวนครั้ง ระยะเวลา และรายละเอียดในการผ่าตัด)

....

....

....

ตอนที่ 3 การตรวจร่างกาย

<u>สมรรถภาพปอด</u>

FVC…………………..ml

FEV_1…………………..ml

FVC/ FEV_1…………….. %

<u>ความยาวขา</u> : ซ้าย...................... cm. ขวา...................... cm.

ค่าเฉลี่ย.................... cm.

<u>Grip strength</u> : ………………… kg.

Grip strength	ครั้งที่ 1	ครั้งที่2	ครั้งที่3
Rt./Lt.			

Functional Reach test : ……........................inches

Functional reach test	ครั้งที่1	ครั้งที่2	ครั้งที่3
……. hand.			

แบบประเมินการทดสอบ 6-minute walk test

จำนวนรอบ : ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

ชื่อ-สกุล ______________________________

วันที่ __________

เพศ : ช ญ อายุ: _____ ปี ความสูง ________ เมตร

น้ำหนัก : ______ กิโลกรัม ความดัน _____/______

ประวัติการรับประทานยาก่อนการทดสอบ (ปริมาณและเวลา)_____________________

____

	ก่อนการทดสอบ	สิ้นสุดการทดสอบ
	____:____	_____ : _____
อัตราการเต้นของหัวใจ	________	_________
อัตราความเหนื่อย	________	_________ (Borg scale)
ระดับการล้า	________	________
SpO_2	______ %	_______ %

หยุดหรือพักก่อนสิ้นสุดการทดสอบหรือไม่: ❒ ไม่ ❒ ใช่ เนื่องจาก

____

อาการอื่นภายหลังสิ้นสุดการทดสอบ : ❒ เจ็บหน้าอก (angina) ❒ เวียนศีรษะ (dizziness)

❒ มีอาการเจ็บสะโพก ขา หรือเป็นตะคริว

❒ อื่น ๆ

จำนวนรอบ: ______ (* 60 เมตร) + ระยะทางที่เหลือที่เดินได้: _______ เมตร

ระยะทางที่เดินทั้งหมดภายในระยะเวลา 6 นาที : ________ เมตร

APPENDIX D
QUALITY OF LIFE QUESTIONNAIRE (SF-36)

แบบสำรวจสุขภาพ SF – 36

แบบสอบถามนี้เป็นแบบสอบถามที่สำรวจความคิดเห็นเกี่ยวกับสุขภาพของท่านเอง ซึ่งจะเป็นคำถามเกี่ยวกับสุขภาพและความสามารถในการทำกิจกรรมโดยทั่ว ๆ ไป

<u>ท่านมีสิทธิ์ที่จะไม่ตอบคำถามข้อใดก็ได้</u> โดยการวงกลมตัวเลือกในแต่ละหัวข้อ ถ้าหากท่านไม่แน่ใจให้เลือกคำตอบที่ท่านคิดว่าใกล้เคียงที่สุด

1. โดยทั่วไปท่านคิดว่าสุขภาพของท่านเป็นอย่างไร (วงกลมหนึ่งคำตอบ)

ดีเลิศ..1

ดีมาก...2

ดี..3

พอใช้...4

ไม่ดี..5

2. เมื่อเทียบกับปีที่แล้ว ท่านคิดว่าสุขภาพของท่านเป็นอย่างไร (วงกลมหนึ่งคำตอบ)

ดีกว่าเมื่อปีที่แล้วมาก...1

ค่อนข้างดีกว่าเมื่อปีที่แล้ว....................................2

เหมือนกับเมื่อปีที่แล้ว..3

ค่อนข้างแย่กว่าเมื่อปีที่แล้ว.................................4

แย่กว่าเมื่อปีที่แล้วมาก..5

3. คำถามต่อไปนี้เป็นคำถามเกี่ยวกับกิจกรรมที่ท่านปฏิบัติในแต่ละวัน ท่านคิดว่าสุขภาพของท่านทำให้ท่านมีปัญหา ในการทำกิจกรรมเหล่านี้หรือไม่ ถ้ามีมากหรือน้อยเพียงใด

(วงกลมหนึ่งคำตอบในแต่ละบรรทัด)

กิจกรรม	**มีปัญหามาก**	**มีปัญหาเล็กน้อย**	**ไม่มีปัญหาเลย**
ก. กิจกรรมที่ต้องใช้แรงมาก เช่น วิ่งนาน ๆ ยกของหนัก ๆ เล่นกีฬาที่ใช้แรงมาก	1	2	3
ข. กิจกรรมที่ต้องใช้แรงปานกลาง เช่น เลื่อนโต๊ะ รดน้ำต้นไม้ ขี่จักรยาน 100 เมตร ซักเสื้อผ้าด้วยตนเอง 8 – 10 ชิ้น	1	2	3
ค. เดินยกหรือหิ้วของชำเต็มสองมือ	1	2	3
ง. เดินขึ้นบันไดหลายขั้นติดต่อกัน	1	2	3
จ. เดินขึ้นบันไดทีละขั้น	1	2	3
ฉ. งอเข่า คุกเข่า ก้มโค้งหรือโน้มตัวลง	1	2	3
ช. เดินมากกว่าหนึ่งกิโลเมตร	1	2	3
ซ. เดินประมาณครึ่งกิโลเมตร	1	2	3
ฌ. เดินประมาณหนึ่งร้อยเมตร	1	2	3
ญ. อาบน้ำ แต่งตัว	1	2	3

4. ในระยะหนึ่งเดือนที่ผ่านมา สุขภาพของท่านทำให้ท่านมีปัญหาเหล่านี้ เวลาทำงานหรือกิจกรรมประจำวัน หรือไม่ ? (ทำเครื่องหมาย / ในคำตอบแต่ละบรรทัด)

กิจกรรม	**มี**	**ไม่มี**
ก. ทำงานหรือกิจกรรมได้ไม่นานเท่าเดิม		
ข. ทำงานได้น้อยกว่าที่ต้องการ		
ค. ไม่สามารถทำงานหรือกิจกรรมบางอย่างได้		
ง. มีความยากลำบากในการทำงานหรือกิจกรรม (เช่น ต้องใช้ความพยายามมากเป็นพิเศษ)		

5. ในระยะหนึ่งเดือนที่ผ่านมา ปัญหาทางอารมณ์ เช่น รู้สึกหดหู่ หรือ วิตกกังวล ทำให้ท่านมีปัญหาเหล่านี้ เวลาทำงานหรือทำกิจวัตรประจำวัน หรือไม่ ? (ทำเครื่องหมาย / ในคำตอบแต่ละบรรทัด)

กิจกรรม	**มี**	**ไม่มี**
ก. ทำงานหรือกิจวัตรประจำวันได้ไม่นานเท่าเดิม		
ข. ทำงานได้น้อยกว่าที่ต้องการ		
ค. มีความระมัดระวังในการทำงานหรือกิจวัตรประจำวันน้อยกว่าเดิม		

6. ในระยะหนึ่งเดือนที่ผ่านมา ปัญหาสุขภาพร่างกาย หรือปัญหาทางอารมณ์ของท่าน มีผลกระทบต่อกิจกรรมทางสังคมที่ท่านทำตามปกติกับ ครอบครัว หรือเพื่อนฝูง หรือเพื่อนบ้าน หรือกลุ่มคนมากน้อยเพียงใด ? (วงกลมหนึ่งคำตอบ)

ไม่มีผลเลย..1

มีผลเล็กน้อย...2

มีผลปานกลาง..3

มีผลค่อนข้างมาก..4

มีผลมาก...5

7. ในระยะหนึ่งเดือนที่ผ่านมา ท่านมีอาการปวดเมื่อยร่างกาย มากน้อยเพียงใด ?

(วงกลมหนึ่งคำตอบ)

ไม่มีเลย..1

มีเล็กน้อยมาก..2

มีเล็กน้อย...3

มีปานกลาง..4

มีมาก...5

มีรุนแรงมาก..6

8.ในระยะหนึ่งเดือนที่ผ่านมา อาการปวดเมื่อยร่างกายของท่านมีผลกระทบต่อการทำงานปกติทั้งงานนอกบ้าน และงานในบ้าน มากน้อยเพียงใด ? (วงกลมหนึ่งคำตอบ)

ไม่เลย..1

เล็กน้อย...2

ปานกลาง...3

ค่อนข้างมาก..4

มากที่สุด..5

9.ในระยะหนึ่งเดือนที่ผ่านมา ท่านมีความรู้สึกต่อไปนี้บ่อยครั้งเพียงใด ? (วงกลมหนึ่งคำตอบในแต่ละบรรทัด)

กิจกรรม	ตลอดเวลา	เกือบตลอดเวลา	บ่อย ๆ	บางครั้ง	นาน ๆ ครั้ง	ไม่มีเลย
ก. ท่านรู้สึกมีชีวิตชีวา	1	2	3	4	5	6
ข. ท่านรู้สึกว่าท่านวิตกกังวล	1	2	3	4	5	6
ค. ท่านเศร้าซึมมากจนไม่มีอะไรทำให้ท่านหายเศร้าซึมได้	1	2	3	4	5	6
ง. ท่านรู้สึกในเย็นและสงบ	1	2	3	4	5	6
จ. ท่านรู้สึกว่าตนเองมีพลังมาก	1	2	3	4	5	6
ฉ. ท่านรู้สึกท้อแท้และหดหู่ใจ	1	2	3	4	5	6
ช. ท่านรู้สึกหมดเรี่ยวแรง	1	2	3	4	5	6
ซ. ท่านรู้สึกว่าตนเองเป็นคนที่มีความสุข	1	2	3	4	5	6
ฌ. ท่านรู้สึกเหนื่อย	1	2	3	4	5	6

10.ในระยะหนึ่งเดือนที่ผ่านมา ปัญหาสุขภาพร่างกายหรือปัญหาทางอารมณ์ของท่าน มีผลกระทบต่อกิจกรรมทางสังคม ที่ท่านทำตามปกติกับครอบครัว หรือเพื่อนฝูง หรือเพื่อนบ้าน หรือกลุ่มคน บ่อยครั้งแค่ไหน ? (วงกลมหนึ่งคำตอบ)

ตลอดเวลา..1

เกือบตลอดเวลา..2

บางครั้ง...3

นาน ๆ ครั้ง...4

ไม่มีเลย...5

11.ข้อความต่อไปนี้ เป็นจริงสำหรับท่านหรือไม่ ? (ทำเครื่องหมาย / ในคำตอบแต่ละบรรทัด)

กิจกรรม	จริงที่สุด	จริง	ไม่รู้	ไม่ค่อยจริง	ไม่จริงเลย
ก. ฉันไม่สบายง่ายกว่าคนอื่น					
ข. ฉันมีสุขภาพดีพอ ๆ กับคนอื่นที่ฉันรู้จัก					
ค. ฉันคาดว่าสุขภาพของฉันจะแย่ลง					
ง. สุขภาพของฉันดีเลิศ					

APPENDIX E
INTERPRETATION OF SF-36

Scale 1: Physical Functioning

Precoded and Final Values for Items 3.1-3.10

Response Choices	Precoded Item Value	Final Item Value
Yes, limited a lot	1	1
Yes, limited a little	2	2
No, not limited at all	3	3

Scale 2: Role-Physical (Physical Role-Limitation)

Precoded and Final Values for Items 4.1-4.4

Response Choices	Precoded Item Value	Final Item Value
Yes	1	1
No	2	2

Scale 3: Bodily Pain

Precoded and Final Values for Items 7

Response Choices	Precoded Item Value	Final Item Value
None	1	6.0
Very mild	2	5.4
Mild	3	4.2
Moderate	4	3.1
Severe	5	2.2
Very severe	6	1.0

Scoring for Item 8 – if both Items 7 and 8 are answered

Response Choices	If Item 8 Precoded Item Value	and Item 7 Final Item Value	then Item8 Final Item Value
Not at all	1	1	6
Not at all	1	2 through 6	5
A little bit	2	1 through 6	4
Moderately	3	1 through 6	3
Quite a bit	4	1 through 6	2
Extremely	5	1 through 6	1

Scoring for Item 8 – if Item 7 is not answered

Response Choices	Precoded Item Value	Final Item Value
Not at all	1	6.0
A little bit	2	4.75
Moderately	3	3.5
Quite a bit	4	2.25
Extremely	5	1.0

Scale 4: General Health

Precoded and Final Values for Items 1& 11.1-11.4

Items 1	Response Choices	Precoded Item Value	Final Item Value
	Excellent	1	5.0
	Very good	2	4.4
	Good	3	3.4
	Fair	4	2.0
	Poor	5	1.0

Items11.1&11.3	Response Choices	Precoded Item Value	Final Item Value
	Definitely True	1	1
	Mostly True	2	2
	Don't Know	3	3
	Mostly False	4	4
	Definitely False	5	5

Items11.2&11.4	Response Choices	Precoded Item Value	Final Item Value
	Definitely True	1	5
	Mostly True	2	4
	Don't Know	3	3
	Mostly False	4	2
	Definitely False	5	1

Scale 5: Vitality

Precoded and Final Values for Items 9.1, 9.5, 9.7 & 9.9

Items 9.1&9.5	Response Choices	Precoded Item Value	Final Item Value
	All of time	1	6
	Most of time	2	5
	A good bit of the time	3	4
	Some of the time	4	3
	A little of the time	5	2
	None of the time	6	1

Items 9.7&9.9	Response Choices	Precoded Item Value	Final Item Value
	All of time	1	1
	Most of time	2	2
	A good bit of the time	3	3
	Some of the time	4	4
	A little of the time	5	5
	None of the time	6	6

Scale 6: Social Functioning

Precoded and Final Values for Items 6&10

Item 6

Response Choices	Precoded Item Value	Final Item Value
Not at all	1	5
A little bit	2	4
Moderately	3	3
Quite a bit	4	2
Extremely	5	1

Item 10

Response Choices	Precoded Item Value	Final Item Value
All of time	1	1
Most of time	2	2
Some of the time	3	3
A little of the time	4	4
None of the time	5	5

Scale 7: Role-Emotional (Emotional Role-Limitation)

Precoded and Final Values for Items 5.1-5.3

Response Choices	Precoded Item Value	Final Item Value
Yes	1	1
NO	2	2

Scale 8: Mental Health

Precoded and Final Values for Items 9.2, 9.3, 9.4, 9.6 & 9.8

Items 9.2, 9.3&9.6

Response Choices	Precoded Item Value	Final Item Value
All of time	1	1
Most of time	2	2
A good bit of the time	3	3
Some of the time	4	4
A little of the time	5	5
None of the time	6	6

Items 9.4&9.8

Response Choices	Precoded Item Value	Final Item Value
All of time	1	6
Most of time	2	5
A good bit of the time	3	4
Some of the time	4	3
A little of the time	5	2
None of the time	6	1

Scale 9: Reported Health Transition

Precoded and Final Values for Item 2

Response Choices	Precoded Item Value
Much better now than one years ago	1
Somewhat better now than one year age	2
About the same as one year ago	3
Somewhat worse now than one year ago	4
Much worse now than one year ago	5

Scale: Formulus for Scoring and Transforming Scales

Scale	**Sum Final Item Values**	**Lowest and highest possible raw scores**	**Possible raw score ranges**
Physical Functioning	3.1+3.2+3.3+3.4+3.5+ 3.6+3.7+3.8+3.9+3.10	10,30	20
Role-Physical	4.1+4.2+4.3+4.4	4,8	4
Bodily Pain	7+8	2,12	10
General Health	1+11.1+11.2+11.3+11.4	5,25	20
Vitality	9.1+9.5+9.7+9.9	4,24	20
Social Functioning	6+10	2,10	8
Role-Emotional	5.1+5.2+5.3	3,6	3
Mental Health	9.2+9.3+9.4+9.6+9.8	5,30	25

$$\text{Transformed Scale} = \frac{\text{(Actual raw score-lowest possible raw score)}}{\text{Possible raw score range}} \times 100$$

Ref: Ware JE, SNOW KK, Kosinski M, Gandek B. (1997). SF-36 Health Survey: Manual and Interpretation guide. Boston, MA: The Medical Outcome Trust.

APPENDIX F
PHYSICAL ACTIVITY QUESTIONNAIRE

แบบประเมินระดับกิจกรรม

กิจกรรม	**สม่ำเสมอ**	**บ่อย**	**บางครั้ง**	**ไม่เคย**
	(4)	**(3)**	**(2)**	**(1)**
1. ท่านเลือกที่จะเดินมากกว่านั่งรถ				
2.ท่านออกกำลังกายมากกว่าหนึ่งครั้งต่อสัปดาห์				
3.ท่านออกกำลังกายอย่างหนัก				
4.ท่านเลือกที่จะเดินขึ้นบันไดมากกว่าการใช้ลิฟท์หรือบันไดเลื่อน				
5.ท่านออกกำลังกายเบา ๆ				
6.ท่านทำกิจกรรมต่าง ๆ ด้วยตัวเองทุกวัน				
7.ท่านหาเวลาว่างในการทำกิจกรรมต่าง ๆ แทนที่จะนั่งดูโทรทัศน์				
8.ท่านเล่นกีฬาอย่างน้อย 1 ครั้งต่อสัปดาห์				

คะแนน กิจกรรม :1)...........+4)………+6)……….+7)……….=……………

การออกกำลังกาย :2)…….. +3)……....+5)……….+8)……… =……………

รวม.....................................คะแนน ระดับกิจกรรม...

$\leq$ 16 inactive 17-23 moderate active $\geq$ 24 active

APPENDIX G
THE ETHICAL COMMITTEE ON RESEARCH INVOLVING HUMAN SUBJECT

COA. No. MU-IRB 2008/097.1609

Documentary Proof of Mahidol University Institutional Review Board

Title of Project. Six-minute Walk Test in Healthy Thai Elderly Aged 60-80 Years (Thesis for Master Degree)

Principle Investigator. Miss Panrampai Thaitrong

Name of Institution. Faculty of Physical Therapy and Applied Movement Sciences

Approval includes. 1) MU-IRB Submission form version received date 11 September 2008
2) Participant Information sheet version date 11 September 2008
4) Informed consent form version date 15September 2008
3) Questionnaire version received date 5 September 2008

Mahidol University Institutional Review Board is in full compliance with International Guidelines for Human Research Protection such as Declaration of Helsinki, The Belmont Report, CIOMSGuidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP)

Date of Approval. 16 September 2008

Date of Expiration. 15 September 2009

Signature of Chairman. ....
(Professor Shusee Visalyaputra)

Signature of Head of the Institute. ....
(Associate Professor Sansanee Chaiyaroj)
Vice President for Research and Academic Affairs

Office of the President, Mahidol University, 999 Phuttamonthon 4 Rd., Salaya, Phuttamonthon District, Nakhon Pathom 73170. Tel. (662) 8496223-5 Fax. (662) 8496223

APPENDIX H
SAMPLE SIZES NEEDED FOR THE CORRELATION COEFFICIENT, r

Table H.1 Sample sizes needed for the correlation coefficient, r

power	r								
	.10	.20	.30	.40	.50	.60	.70	.80	.90
α_1=.05									
.70	470	117	52	28	18	12	8	6	4
.80	617	153	68	37	22	15	10	7	5
.90	854	211	92	50	31	20	13	9	6
α_2=.05									
.70	616	153	67	37	23	15	10	7	5
.80	783	194	85	46	28	18	12	9	6
.90	1047	259	113	62	37	24	16	11	7

Portney LK, Watkins MP. Sample sizes needed for the correlation coefficient, r. In: Mehalik C, EDITOR. Foundations of clinical research. Applications to practice. New Jersey: Prentice Hall; 2000. p.724.

APPENDIX I
RAW DATA OF THE STUDY

Table I.1 Demographics data of the subjects (n=150)

Subjects	Sex	Age	Weight	Height	BMI	Leg length	Physical activity
1	1	67	51	159	20.2	94	2
2	2	71	55	170	19.0	90	3
3	1	78	55	151	24.1	66.5	3
4	1	70	50	150	22.2	88	2
5	2	73	78	178	24.6	102	3
6	1	64	75	157	30.4	90	2
7	1	75	74	150	32.9	73.75	2
8	1	71	70	165	25.7	100	2
9	1	66	56	154	23.6	80	2
10	1	77	47	140	24.0	70.25	3
11	1	70	64	156	26.3	76.5	3
12	1	65	76	157	30.8	73	3
13	1	75	53	156	21.8	73.5	2
14	1	65	58	157	23.5	77.5	2
15	1	68	50	150	22.2	74.5	2
16	1	64	42	150	18.7	71	2
17	1	71	58	154	24.5	83	3
18	1	62	61	160	23.8	71.5	2
19	1	74	58	156	23.8	72	2
20	1	77	52	150	23.1	89	3
21	1	75	54	151	23.7	83	3
22	1	62	70	150	31.1	87	2
23	1	73	90	160	35.2	87.5	3
24	1	63	53	156	21.8	92	2
25	1	69	45	140	23.0	82	2
26	1	67	54	155	22.5	69	2
27	1	63	59	158	23.6	92	3
28	1	68	57	150	25.3	90	2
29	1	70	74	160	28.9	92	3
30	1	62	50	150	22.2	70	2
31	1	65	59	150	26.2	69	2

Table I.1 Demographics data of the subjects (n=150) (Continued)

Subjects	Sex	Age	Weight	Height	BMI	Leg length	Physical activity
32	1	60	70	155	29.1	84	3
33	1	71	75	151	32.9	70	2
34	1	62	63	160	24.6	84	3
35	1	71	51	146	23.9	68	3
36	1	80	57	155	23.7	70	3
37	1	66	59	164	21.9	79	2
38	1	65	58	157	23.5	82	2
39	1	64	61	153	26.1	82	3
40	1	72	53	154	22.4	71.5	2
41	1	65	58	150	25.8	68.5	2
42	1	74	57	147	26.4	68.5	2
43	1	64	43	150	19.1	80	2
44	1	69	55	158	22.0	86	3
45	2	64	70	168	24.8	90	2
46	1	65	51	149	23.0	83	3
47	1	71	56	155	23.3	86	3
48	1	68	56	157	22.7	71	2
49	1	62	63	156	25.9	89	3
50	1	73	55	150	24.4	72.5	2
51	1	75	60	163	22.6	76	2
52	1	64	52	150	23.1	87	3
53	1	69	49	156	20.1	83	2
54	1	75	64	154	27.0	69	3
55	1	63	51	152	22.1	71.5	2
56	1	63	52	150	23.1	67	2
57	1	67	59	158	23.6	90.5	2
58	1	74	53	148	24.2	87	3
59	2	72	74	170	25.6	93	3
60	1	77	54	146	25.3	88	3
61	1	71	56	150	24.9	70	2
62	1	72	60	160	23.4	79	2
63	1	66	40	145	19.0	88	2
64	1	70	60	154	25.3	88	2
65	1	75	52	160	20.3	93	2
66	2	74	65	176	21.0	79	3
67	1	79	55	149	24.8	83	2
68	1	80	35	148	16.0	74.25	3
69	1	71	56	146	26.3	72.5	3
70	2	62	60	162	22.9	88	2
71	1	72	50	154	21.1	90	3
72	1	72	50	152	21.6	86	3
73	1	75	52	150	23.1	90	3

Table I.1 Demographics data of the subjects (n=150) (Continued)

Subjects	Sex	Age	Weight	Height	BMI	Leg length	Physical activity
74	1	70	50.5	155	21.0	92	2
75	1	63	59	157	23.9	91	3
76	1	78	40	146	18.8	83	2
77	1	60	60	150	26.7	84	3
78	1	80	48	146	22.5	79	3
79	1	68	55	157	22.3	94	3
80	1	60	56	156	23.0	86	3
81	1	61	65	155	27.1	66	2
82	2	73	70	163	26.4	76	3
83	1	72	54	150	24.0	67.5	2
84	1	68	52	152	22.5	69	3
85	1	68	65	162	24.8	89	2
86	1	80	50	150	22.2	69	1
87	1	65	45	155	18.7	70	3
88	1	73	44	150	19.6	70	2
89	1	71	57	150	25.3	70.9	2
90	1	74	55	154	23.2	70	3
91	1	80	62	152	26.8	81	2
92	1	71	56	158	22.4	74	2
93	1	71	56	148	25.6	71	3
94	1	75	48	154	20.2	71	2
95	1	68	54	150	24.0	70	3
96	1	77	55	155	22.9	71	3
97	1	78	58	145	27.6	78.5	2
98	1	69	54	147	25.0	71	3
99	1	62	56	156	23.0	70	3
100	1	65	55.5	151	24.3	74	2
101	1	73	65	160	25.4	72	1
102	1	78	49	158	19.6	75	2
103	1	72	52	147	24.1	84	3
104	1	64	56	158	22.4	75	2
105	1	75	59	152	25.5	71	3
106	1	78	58	152	25.1	89	3
107	1	68	56.5	152	24.5	68	2
108	1	65	57	160	22.3	76	2
109	1	73	50	149	22.5	70	2
110	1	74	74	160	28.9	74	2
111	1	79	48	154	20.2	87	3
112	1	60	55	148	25.1	68	2
113	1	65	57.5	153	24.6	71	3
114	1	62	60	147	27.8	82	2
115	1	70	60	158	24.0	71	2
116	2	70	67	166	24.3	92	3

Table I.1 Demographics data of the subjects (n=150) (Continued)

Subjects	Sex	Age	Weight	Height	BMI	Leg length	Physical activity
117	1	73	75	155	31.2	87	3
118	2	78	70	169	24.5	97	3
119	2	80	80	170	27.7	96	3
120	1	64	66	150	29.3	83	2
121	1	64	62	157	25.2	88	2
122	1	67	60	151	26.3	88	3
123	1	78	54	152	23.4	84	3
124	2	80	65	155	27.1	85	3
125	1	62	63	150	28.0	87	3
126	1	74	48	155	20.0	92	3
127	1	70	53	153	22.6	88	3
128	1	64	64	148	29.2	81	2
129	1	80	43	147	19.9	76	3
130	1	62	66	152	28.6	89	3
131	2	70	65	165	23.9	93	3
132	1	79	65	145	30.9	74	3
133	1	65	72	149	32.4	78	2
134	1	73	43	150	19.1	78	3
135	1	61	80	150	35.6	80	3
136	1	68	56	155	23.3	88	3
137	1	75	46	146	21.6	86	3
138	1	62	70	160	27.3	90	3
139	1	65	46	158	18.4	86	2
140	1	71	76	150	33.8	74	2
141	1	61	70	150	31.1	85	2
142	1	77	63	157	25.6	86	3
143	1	60	47	157	19.1	86	2
144	1	75	65	150	28.9	84	2
145	1	80	49	156	20.1	87	2
146	1	75	40	148	18.3	81	3
147	1	75	51	152	22.1	87	2
148	1	77	87	165	32.0	90	2
149	1	74	49	159	19.4	87	2
150	1	80	53	152	22.9	84	3

Table I.2 Outcomes of physical examination (n=150)

Subjects	Hand grip strength	Functional reach distance	Six-minute walk distance
1	23.3	12	458
2	34.7	12.5	590
3	13.4	4	240
4	20.7	11.5	488
5	35.9	13	449
6	12.8	13	436
7	19	6	240
8	27.4	12	425
9	25.1	11	353
10	17.2	7.5	333
11	24.8	9.5	287
12	31.8	11	471
13	21.4	12	515
14	27.1	11.5	427
15	26.7	12	431
16	24	14	531
17	16.8	10	300
18	18.6	11	420
19	19.1	9	300
20	20.3	11	495
21	18.2	7.5	300
22	19.7	9	360
23	19.9	8	390
24	29.6	14	480
25	18.8	10	493
26	22.2	12	527
27	26.1	12	483
28	19.9	12	510
29	29.1	11	486
30	19	11	510
31	26.5	12	570
32	27.4	11	473
33	22.2	11	420
34	19.7	12	500
35	17.6	10	438
36	27.4	14.5	450
37	30.9	11.5	469
38	25.9	12	540
39	20.4	13	430
40	23.9	10	443
41	21.2	11	450
42	24.2	11.5	384

Table I.2 Outcomes of physical examination (n=150) (Continued)

Subjects	Hand grip strength	Functional reach distance	Six-minute walk distance
43	24.5	12	529
44	17.8	13.5	413
45	36.3	14.5	609
46	13.5	9.5	480
47	16	10	333
48	25.7	14.5	525
49	24.6	11	390
50	25	5	420
51	24.5	6	390
52	28	12	519
53	25.8	13	638
54	20.7	11	442
55	24.9	12.5	460
56	19.1	10.5	390
57	22.5	9	420
58	18.5	9	346
59	33.2	13	450
60	16.6	12	480
61	20.5	6	395
62	24	12	425
63	16.9	11	464
64	21.9	15	436
65	25.4	11	400
66	32.1	10.5	494
67	14.7	8.5	302
68	20.3	8	442
69	19.9	8	332
70	29.7	10.5	619
71	23.5	12.5	391
72	22.9	10	450
73	21.7	12	587
74	20.4	11.5	430
75	22.2	12	518
76	17.8	11	510
77	17.1	10	420
78	14.9	10	453
79	26.8	12	555
80	28.4	13	543
81	31	12.5	600
82	40.9	15	405
83	23.6	7.5	348
84	21.9	11.5	437

Table I.2 Outcomes of physical examination (n=150) (Continued)

Subjects	Hand grip strength	Functional reach distance	Six-minute walk distance
85	19.3	13	411
86	17.9	12.5	395
87	21	13.5	491
88	15.9	10.5	390
89	16.9	11.5	363
90	20.1	10	367
91	18.6	9.5	330
92	25.9	14	504
93	22.9	10.5	470
94	19.9	11	435
95	20.9	12	435
96	18.5	10.5	480
97	14.7	11.5	338
98	16.7	4.5	345
99	18.2	11	470
100	29.9	14.5	536
101	20.9	8.5	335
102	20.9	9.5	400
103	19	10.5	378
104	21.6	10.5	513
105	19.1	5	354
106	19.4	10	399
107	21.9	13.5	480
108	18.8	9	308
109	14.6	9.5	390
110	19.9	8.5	368
111	19.7	13.5	540
112	27.2	13.5	450
113	25.8	11.5	467
114	17.2	10	345
115	16.3	10.5	398
116	28	12	465
117	22	12	465
118	35	10	390
119	32	13.5	453
120	18	12.5	450
121	23	13	477
122	26	10	475
123	21	8	390
124	30	7.5	345
125	22.5	8	375
126	20	9.5	375

Table I.2 Outcomes of physical examination (n=150) (Continued)

Subjects	Hand grip strength	Functional reach distance	Six-minute walk distance
127	18	14	491
128	17.5	12	429
129	15.5	10	345
130	25.5	7	420
131	32	14	559
132	20	12	437
133	24	12	426
134	18	11.5	420
135	19	12	426
136	20	13	480
137	11	10	413
138	29.5	12.5	480
139	29	14.5	561
140	20.5	9	360
141	18	12	442
142	20	10.5	420
143	20.5	12	420
144	23	10	420
145	18	8	360
146	15	9.5	340
147	21	9.5	300
148	26	10	390
149	21	10.5	394
150	20	7	392

Table I.3 Pulmonary function test (n=50, No.1-50)

Subjects	FVC	FEV1	FEV1/FVC
1	2.07	1.63	78
2	2.38	1.99	83
3	1.61	1.47	91
4	1.42	1.29	91
5	2.2	1.9	86
6	2.34	1.7	72
7	1.22	1.11	91
8	1.96	1.69	86
9	1.84	1.47	79
10	1.5	1.34	89
11	2.05	1.67	81
12	2.14	1.81	84
13	1.37	1.2	87
14	1.85	1.78	96
15	1.23	0.92	74
16	1.73	1.42	81
17	1.23	0.98	79
18	1.66	1.43	86
19	1.97	1.71	87
20	1.51	1.25	82
21	1.45	1.29	88
22	1.5	1.36	90
23	2.1	1.73	82
24	1.93	1.63	83
25	1.33	1.15	86
26	2.37	2.34	98
27	2.63	1.86	70
28	1.64	1.56	94
29	2.17	1.77	81
30	2.58	2.25	87
31	2.32	2.08	89
32	2.37	2.13	89
33	2.25	1.88	83
34	2.03	1.71	84
35	1.44	1.04	72
36	2.58	2.12	82
37	2.63	2.27	86
38	2.1	1.58	75
39	2.23	1.79	80
40	1.81	1.65	91
41	1.82	1.53	83
42	1.89	1.64	86
43	2.4	1.86	77

Table I.3 Pulmonary function test (n=50) (Continued)

Subjects	FVC	FEV1	FEV1/FVC
44	1.84	1.35	72
45	3.64	3.06	83
46	1.89	1.5	79
47	2.5	2.03	80
48	1.72	1.54	89
49	2.18	1.91	87
50	1.89	1.7	90

Table I.4 SF-36 quality of life scores (n=150)

Subjects	SF-36 PF	SF-36 RP	SF-36 BP	SF-36 GH	SF-36 VT	SF-36 SF	SF-36 RE	SF-36 MH
1	90	100	90	82	70	100	100	84
2	90	100	90	65	65	100	100	72
3	60	0	62	82	80	87.5	0	96
4	85	100	90	77	85	87.5	100	96
5	35	50	62	30	55	62.5	66.67	76
6	35	0	22	52	85	37.5	0	76
7	55	25	72	50	40	87.5	0	56
8	90	100	62	55	50	75	100	96
9	50	100	84	77	60	75	66.67	72
10	90	100	72	55	65	75	100	68
11	50	100	72	75	65	100	100	100
12	90	100	90	72	100	100	100	100
13	90	50	51	40	85	100	66.67	92
14	85	100	90	50	65	100	100	80
15	90	100	72	50	35	100	66.67	76
16	95	100	72	65	60	100	100	72
17	75	100	90	40	50	50	100	56
18	65	75	72	40	60	100	100	76
19	30	75	42	50	50	100	66.67	84
20	100	100	90	90	50	100	100	100
21	75	100	62	50	70	87.5	100	84
22	60	100	74	52	50	50	100	52
23	60	75	52	45	50	100	66.67	60
24	100	100	84	77	80	100	100	80
25	75	75	52	62	70	75	100	76
26	60	25	51	52	50	100	0	60
27	80	50	81	77	75	100	100	64
28	75	100	51	60	60	37.5	100	56
29	65	100	72	67	35	87.5	100	80
30	75	50	74	40	65	100	0	52

Table I.4 SF-36 quality of life scores (n=150) (Continued)

Subjects	SF-36 PF	SF-36 RP	SF-36 BP	SF-36 GH	SF-36 VT	SF-36 SF	SF-36 RE	SF-36 MH
31	70	25	52	70	70	75	100	56
32	85	100	41	57	60	75	100	72
33	25	25	51	60	50	87.5	100	100
34	75	100	41	60	50	87.5	100	68
35	70	100	84	72	65	37.5	0	64
36	90	100	90	67	70	100	100	80
37	95	100	90	72	70	100	100	88
38	95	100	90	67	75	100	100	80
39	55	100	62	67	70	62.5	100	76
40	95	100	84	65	75	100	33.33	92
41	85	100	84	65	75	100	100	100
42	90	100	62	55	80	100	100	88
43	45	100	41	40	65	50	100	56
44	90	100	74	82	75	100	66.67	96
45	85	100	90	77	75	75	0	80
46	75	100	61	62	65	87.5	100	88
47	85	100	61	67	60	100	100	92
48	100	100	62	82	95	100	100	88
49	65	100	62	55	60	100	100	80
50	85	100	90	60	90	100	100	92
51	70	25	62	62	85	100	100	100
52	80	100	74	65	85	75	100	68
53	95	25	62	35	60	75	66.67	60
54	60	50	32	45	45	100	0	60
55	90	50	62	57	60	100	66.67	96
56	90	100	72	72	70	100	33.33	88
57	70	25	41	45	55	62.5	100	72
58	100	100	62	82	80	100	0	92
59	85	100	62	62	70	100	100	96
60	90	100	62	52	70	100	100	88
61	90	50	90	55	70	87.5	100	88
62	100	100	90	60	100	100	100	100
63	60	0	62	55	75	75	100	88
64	50	0	74	72	60	100	0	72
65	60	0	32	15	70	100	0	100
66	60	0	52	42	55	50	100	72
67	80	100	51	60	75	100	0	92
68	65	75	72	57	55	87.5	66.67	80
69	95	100	72	65	70	87.5	100	92
70	95	50	80	77	45	100	100	60
71	75	100	74	72	90	62.5	100	92
72	90	100	41	77	70	62.5	100	56

Table I.4 SF-36 quality of life scores (n=150) (Continued)

Subjects	SF-36 PF	SF-36 RP	SF-36 BP	SF-36 GH	SF-36 VT	SF-36 SF	SF-36 RE	SF-36 MH
73	90	75	72	82	80	87.5	100	88
74	80	0	41	77	60	62.5	100	84
75	95	100	84	87	95	100	0	96
76	95	100	51	87	95	62.5	100	80
77	80	100	62	67	80	100	66.67	80
78	85	100	84	87	95	100	100	100
79	95	100	62	57	65	87.5	100	72
80	85	100	62	72	60	100	100	76
81	80	75	51	77	55	100	66.67	60
82	100	100	62	55	50	87.5	100	60
83	80	100	62	50	70	100	100	80
84	100	100	72	60	40	100	100	64
85	55	0	74	50	45	62.5	0	52
86	50	50	62	40	50	87.5	0	68
87	75	100	72	55	90	87.5	100	64
88	70	50	72	50	80	100	0	76
89	50	0	51	25	40	50	0	56
90	85	100	90	82	75	100	100	84
91	60	100	90	40	50	75	66.67	36
92	80	50	64	55	50	62.5	33.33	56
93	45	100	41	67	55	75	100	72
94	90	50	62	50	60	100	100	76
95	85	100	90	87	50	100	100	92
96	55	100	90	55	60	50	100	72
97	30	50	31	47	20	50	0	56
98	100	100	72	92	85	100	100	96
99	85	100	84	60	75	62.5	100	88
100	85	100	62	45	75	62.5	100	60
101	50	100	74	20	40	100	100	96
102	40	100	62	60	75	100	100	96
103	70	100	51	77	55	100	100	88
104	45	0	22	30	75	75	100	80
105	95	100	84	67	45	100	100	96
106	70	100	41	75	60	100	0	72
107	70	100	74	87	90	100	100	96
108	45	75	62	45	65	75	100	68
109	100	100	90	67	95	100	100	96
110	70	100	62	50	40	100	0	80
111	100	100	84	77	65	87.5	100	68
112	75	100	72	62	65	37.5	100	68
113	95	100	84	62	80	100	100	88
114	55	100	22	30	60	50	100	28

Table I.4 SF-36 quality of life scores (n=150) (Continued)

Subjects	SF-36 PF	SF-36 RP	SF-36 BP	SF-36 GH	SF-36 VT	SF-36 SF	SF-36 RE	SF-36 MH
115	50	100	74	55	35	87.5	100	76
116	100	100	84	87	75	75	100	68
117	95	100	90	50	80	100	100	84
118	100	100	72	87	75	100	100	84
119	90	100	90	72	75	100	100	80
120	90	100	90	75	75	100	100	72
121	90	100	72	57	75	100	100	80
122	95	100	62	62	70	87.5	100	80
123	75	100	72	35	60	75	100	84
124	80	100	62	42	55	87.5	100	84
125	35	50	51	57	55	62.5	0	76
126	90	25	72	45	60	87.5	100	76
127	100	100	90	92	100	100	33.33	88
128	80	100	72	72	70	100	100	80
129	85	100	72	62	60	87.5	100	68
130	80	100	72	52	75	100	100	88
131	80	100	62	55	55	62.5	0	68
132	100	100	72	82	100	100	100	100
133	75	100	41	45	75	62.5	0	56
134	80	100	74	45	60	100	100	80
135	90	100	62	67	90	75	66.67	84
136	75	0	31	52	60	50	100	92
137	65	100	62	50	70	62.5	100	84
138	95	100	62	55	75	87.5	100	88
139	90	100	74	50	60	100	100	68
140	50	50	41	25	50	62.5	100	76
141	60	0	52	40	55	50	0	72
142	70	100	62	50	75	87.5	100	84
143	75	100	84	72	75	87.5	100	88
144	60	100	72	62	65	100	100	80
145	90	25	90	45	80	100	100	84
146	80	25	72	72	65	75	0	96
147	55	100	74	57	55	87.5	100	84
148	55	0	72	50	65	62.5	100	92
149	70	100	74	50	55	100	100	84
150	30	0	62	67	75	100	0	80

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