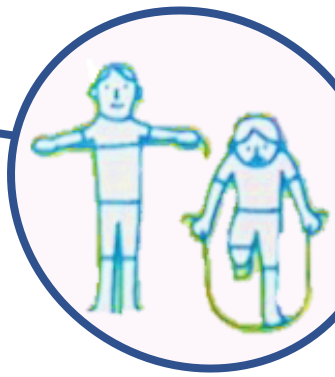
Verification Survey with the Private Sector for Disseminating Japanese Technologies for Health Promotion for the Elderly by Applying Japan's Preventive Care System



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Verification Survey with the Private Sector for Disseminating Japanese Technologies for Health Promotion for the Elderly by Applying Japan's Preventive Care System

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Preface

Thailand is considered an aged society. Number of older people are increasing considerably. Their quality of life also depends on the physical ability of older persons in types of movement needed for activities of daily living (ADLs).

This report presents the results from applying Japanese Self-Sustained Movement (SSM) program to Thai elderly, including establishing a standard of physical movement ability for Thais and assessment of changes in physical activities after implementation of the SSM program. The physical ability includes walking, general bodily movement, manual dexterity, and change in posture

The data collection was carried out by Ministry of Public Health, Region 8 with the support from Shizuoka University, Hatachi Industry Co. and Japan International Cooperation Agency (JICA). We would like to thank all participating organizations for their technical and financial support, statistical data, as well as useful suggestions.

Working Committee of the Report on Verification Survey with the Private Sector for Disseminating Japanese Technologies for Health Promotion for the Elderly by Applying Japan's Preventive Care System

Executive Summary

Thailand is a rapidly aging society, largely due to a steady decline in fertility over the past half-century, and increased longevity of the population. However, for a country to accommodate such a large influx of elderly persons, it is important that people age as healthily as possible. Inevitably, as a person ages, they will experience a natural decline in physical ability, and most will become increasingly dependent on others for activities of daily living (ADLs) to one degree or another. However, when experienced on a large scale, that dependence can begin to impose serious strains on the economy, care and welfare systems of the country. Thus, any intervention that can delay the time when an older person becomes dependent (i.e., loses self-reliance) will be of benefit, not only to the individual, but also to the family, community and society at-large.

Japanese researchers from Shizuoka University and Hatachi Industry Co. developed a successful program to strengthen the physical ability of older persons in types of movement needed for ADLs. This program is called Self-Sustained Movement (SSM). The SSM has been formalized into a set of exercises which are simple to learn and implement, even by the elderly themselves in the limited space of their own home. The SSM Program includes a software application to help in the assessment of performance, before, during, and after implementing the training. That way, each individual can track their progress as a self-reinforcing mechanism to keep them motivated to implement the SSM exercise regimen as a part of daily life. Importantly, the SSM Program can help the weaker elderly to become self-reliant for ADL. Those who are already self-reliant can maintain their physical ability as they age in order to delay, indefinitely, the time when they become dependent on others. This is the goal of the healthy aging philosophy as adopted by countries around the world, including Thailand.

Given the success of the SSM in Japan, there was interest in replicating the Program with other populations of elderly in the Asia region. Accordingly, the Japan International Cooperation Agency (JICA) in collaboration with Shizuoka University and the Hatachi Co., developed a proposal with the Thai Ministry of Public Health (MOPH) to conduct a pilot replication of the SSM in one health zone of the country (Zone #8). The Institute for Population and Social Research and the College of Sports Science and Technology, both of Mahidol University, were commissioned to conduct the academic work for the data

analysis of the SSM. The specific objectives of the pilot study are to establish a standard of physical movement ability for Thais and to assess the impact of applying the SSM Program on the physical ability of a sample of Thai elderly.

The pilot project was implemented in the following two phases:

1) Phase 1 : Preparation: First, a Task Force was appointed to oversee the replication of the SSM Program in Thailand. Next, there was training of SSM Master Trainers in the Self-sustained Movement regimen of exercises. This was followed by preliminary data collection among a group of Thai older persons to create a standard measurement which suits the Thai elderly population.
2) Phase 2: Pilot Project: This involved a selection of a sample of older persons, baseline data collection, implementation of the SSM program, and follow-up assessment of change.

The following presents more detail of these two phases.

Phase 1: Establishing a standard of physical movement ability for Thais

The first activity was training Master Trainers in the SSM Program. These trainers are the key personnel who would help instruct elderly in how to implement the SSM regimen of exercises in the pilot project phase. There were 6 Master Trainers from Health Zone #8, MOPH, including Udon Thani, Nongkhai, and Nong Bua Lamphu Provinces and 2 Master Trainers from the Colleage of Sports Science and Technology, Mahidol University.

A sample of 560 persons were from Mumoan and Mahkaeng Sub-districts of Udon Thani in order to calculate Thai standard values for physical ability. The data were collected during 23-27 April and 6-7 November 2018.The sample comprised 265 males and 295 females. Of these, 453 had scored at least 15 points (out of 20) on the Barthel Index of ability to perform ADLs. The remaining 107 scored from 12-14 points. The sample was stratified by five-year age group to include persons age 60-64, 65-69, 70-74, 75-79, and 80 years or older.

Participants were assessed for four types of physical ability: Walking, general bodily movement, manual dexterity, and change in posture. The results of the assessment are as follows:

1) The time required to perform the tests of physical ability across the four types of movement increased with age, for both males and females.
2) The male and female participants required the least amount of time for the test of bodily movement, followed by posture change, walking, and manual dexterity, respectively.
3) Male older persons out-performed their female counterparts (in terms of speed in performing the tests).

Scores from the four tests were used to classify into five types of animals, i. e. Cheetah (the fastest speed), followed by horse, Dog, Rabbit and Turtle respectively.

Phase 2: Pilot project

The initial sample included 490 persons: 240 from Udon Thani, 120 from Nongkhai, and 130 from Nong Bua Lamphu. In each province, sample participants were divided into Experimental (trained) and Control (non-trained) groups. The training in the SSM lasted for three months. There are four datasets for analysis as follows:

1) **Dataset #1:** This compares the physical ability of the participants in the Experimental group (Group 1: received the 3-month SSM training) and the Control group (Group 2: did not receive the SSM training but were allowed to perform physical movement as part of ADL). This dataset covers the period from January to March, 2019
2) **Dataset #2:** The participants in Groups 1& 2 were switched, so that those who had been trained became the Control group, while the Control group became the Experimental group: Group 1: Training to control (Control); Group 2: Control to train (Training). This dataset covers the period from April to June, 2019.
3) **Dataset #3:** This dataset includes the comparison between Dataset #1 (Group 1: Training) and Dataset #2 **(**Group 2: Training).

4) **Dataset #4**: This dataset compares tests of physical ability at three time periods: Before training (Month 0), after three months of training (Month 3), and at three months after the end of training (Month 6). The data for Month 6 were collected in October 2019.

The results of the analysis of the four datasets show that the Japanese model of SSM Program training is applicable in the Thai setting, and can boost the ability of older persons to perform ADLs. Improvement was especially pronounced for walking and posture change, and these improvements were statistically significant. Better ability to perform just these two movements can help reduce accidental falls and associated injuries.

In addition, this pilot study found that the SSM Program is most effective for those elderly who are already frail (e.g. Rabbit and Turtle levels). The training was able to significantly improve movement ability for these individuals, and that should help to increase self-reliance and delay the time when they become dependent on others for ADLs.

The SSM Program has a regimen of exercises that is easy to learn and implement, even in the confined space of a household. The exercises are not so strenuous that they might threaten an older person's health or safety. Thus, the SSM Program is appropriate for Thai elderly and should be replicated in other places.

Table of contents

Table of contents

List of Tables

Page

List of Tables (continued)

List of Tables (continued)

Page

List of Tables (continued)

List of Tables (continued)

Page

List of Figures

List of Figures (continued)

Page

Chapter 1

Introduction

1.1 Background and Importance of the Problem

At present, Thailand has advanced into an “aged society.” In 2019, there were 11.6 million Thai people age 60 years or over, or 18% of the total population. It is estimated that, by 2022, Thailand will become a “complete aged society" when the population age 60 years or over accounts for at least 20 percent of the total population. By 2033, it is projected that Thailand will become a "super aged society", whereby the population age 60 years or over accounts for at least 28 percent of the total population (Office of the National Economic and Social Development Council, 2019).

The Survey of Older Persons of the National Statistical Office (NATIONAL STATISTICAL OFFICE) in 2007 found that 95% of persons over the age of 60 could do their own daily activities, including eating, dressing, bathing, and toileting. However, it is a certainty that this percent will decrease with increasing age. Indeed, the 2017 survey also reported that one out of five persons age 80 years or older were unable to do these activities of daily living (ADLs) independently.

According to a study by Milanovic et al. (2013), physical activity that decreases with age is associated with deterioration of anthropometry and physical fitness of the body for example decreased muscle size, increased proportion of fat mass, reduced muscle strength, reduced dexterity, reduced flexibility, etc. These changes could reflect the ability to perform ADLs with having to rely on others. Recently, many studies demonstrated the importance of regular physical activity in the elderly to slow the deterioration of anthropometry and physical fitness, and prolong the time for the elderly to live everyday life independently.

Therefore, this rapid increase in the number and proportion of the population which is elderly is causing Thailand to rush to prepare for this “socio-demographic Tsunami” which is looming. This situation is a challenge for the government, community, and family in terms of health care, living expenses, and appropriate housing. The increasing number of elderly

(both in urban and rural areas), living alone or only with their spouse, and the corresponding change in the population age structure, may result in a shortage of younger care providers, thus placing an increased burden on families to care for elderly members, coupled by an increase in the prevalence of loneliness and isolation of older persons. In addition, there will be more accidents and injuries that frail elderly are most vulnerable to, such as falls which cause broken or cracked hips or head injury. Therefore, the Thai Ministry of Public Health (MOPH) has a policy to promote healthy aging of the entire population, and especially the elderly, and to encourage all age groups to see the importance of exercise and physical activity in every form as the major means to achieve this goal.

It is well known that Japan had an aged society many years before Thailand reached that milestone. Currently, the life expectancy at birth in Japan is 81 years for males and 87 years for females (United Nations, 2019). That indicator compares with 73 years for males and 80 years for females in Thailand (Institute for Population and Social Research, 2019). In order to help older persons age with happiness, health, reduced financial dependence on the state, and reduced dependence on care givers, Profs. Nakano Mieko and Yokoyama Yoshiaki of Shizuoka University in 2006 developed the program called "Self-Sustained Movement" (SSM). The SSM has worked quite well and there were many seniors interested in participating in the program. Later, the Hatachi Industry Co. produced products to assist in exercise training under the supervision of Shizuoka University, Japan. The SSM applied the movement skills of the body in daily life to design a test and exercise training program to maximize these skills. The developers also created software to be used in the assessment as well so that the users can know the results of their physical fitness in order to improve their performance. Evaluation of the SSM found that both elderly who are physically weak and those who need help in some ADLs can become more independent. In addition, elderly who are still healthy and those who do not need help doing ADLs can extend the period of healthy aging. The SSM program is recognized and endorsed by the Meiji Yasuda Life Foundation of Health and Welfare, and the Ministry of Education, Culture, Sports, Science and Technology of Japan. In 2017, there were 270 organizations, 1,000 groups or a population of 25,000 in Japan who were actively participating in the SSM program.

There are three steps in implementing the SSM program: (1) The Self- Sustained Movement Test (SSM test) of older persons; (2) Coaching and advice on the appropriate exercise by a certified SSM 'Master' trainer; and (3) Practicing the activity as prescribed by the program.

The SSM approach has three main advantages: It is easy to learn, fun to implement, and is motivational. When seniors start implementing the SSM, they realize that exercise does not have to be monotonous. Indeed, the program actually makes the practitioner feel stronger and more independent in daily life.

Japan was interested in replicating the SSM in Thailand to address the emerging challenges of a rapidly-aging population. Also of interest is the need to ensure the viability of the medical and social insurance systems in the future with such a large proportion of the population that will be elderly.

To that end, the Hatachi Co. promoted the replication of the SSM program in the Udon Thani Provincial Hospital from May, 2015 to March, 2016. That feasibility study found that the SSM program could be successfully adapted to an urban area of northeast Thailand. Accordingly, the Japan International Cooperation Agency (JICA), in collaboration with Hatachi Co. and Shizuoka University, developed a proposal to implement the SSM program on a wider scale through a partnership with the Thai MOPH. This proposal became the pilot research project "Verification Survey with the Private Sector for Disseminating Japanese Technologies for Health Promotion for the Elderly by Applying Japan's Preventive Care System" which is designed to assess whether elderly Thai can live independently longer and retard the physical deterioration process by implementing the SSM. The MOPH identified a target area for implementation of the pilot replication and evaluation research. It was agreed that the MOPH would conduct the field implementation of the program and collect the primary data. Then two academic institutions were commissioned to analyze the data: Institute for Population and Social Research and the College of Sports Science and Technology, both of Mahidol University.

1.2 Goal and Research Objectives

Goal of the study

The introduction and dissemination of the SSM program in Thailand will contribute to the promotion of solutions which will lead to the sustainability of the care and treatment subsidy budget, which is a main development strategy in Thailand.

Objectives of the survey

The pilot research of the SSM program is to be conducted in many provinces under the jurisdiction of MOPH Health Zone #8 to verify the benefits of this program. After explaining the purpose and expected benefit of the assessment to the participating government agencies, the research team will conduct a review of issues and methods of program replication.

Objectives of the research

The specific objectives of this portion of the pilot research is to analyze change in physical ability and independence in activities in daily living (ADLs) of the elderly who exercised in accordance with the Japanese program of preventive care (i.e., SSM).

1.3 Expected benefit of the research

1. Provide a basis for the replication of the SSM in Thailand.
2. To assess the applicability of the SSM in Thailand and the expected benefit.
3. To produce a review and recommendations for implementing the SSM program in MOPH Health Zone # 8 and in other regions of the country.
4. To develop a plan for the dissemination of findings for further action.

Chapter 2

Literature Reviews

This chapter presents the situation of the increasing population of Thai elderly, and the health status and the dependence of the Thai elderly in accordance with the standard framework of the MOPH. This review also documents studies of the decline in physical performance that normally accompanies natural aging, including methods of measuring physical fitness and the Japanese self-help development program that will be used with Thai elderly. The Japanese program (SSM) consists of principles for training for physical fitness in various actions including walking, body movement, manual dexterity, and changing posture in performing ADLs.

2.1 Situation of aging in Thailand

2.1.1 Structure of the elderly population

At present, Thailand has completed the transition to a low-birth society with increased life expectancy. This has produced dramatic changes in the age structure of the population, with an exceptionally rapid increase in the proportion of the population who is elderly. Thus, as of 2019, Thailand was classified as an aged society since the proportion of the population age 60 years or older was 18% of the total population. By the year 2033, it is projected that Thailand will have become a super aged society with 28% of the total population being age 60 years or older (National Economic and Social Development Council, 2019).

Reduced number of births and increased longevity is the main cause of the aging of the Thai population

It is clear that the growth of the Thai population is slowing, and that is primarily the result of a decline in fertility over a half-century. Combined with an increased longevity of the population, these demographic forces are causing a dramatic change in the age structure of the population. For example, the proportion of Thais age under 15 years is declining while the proportion of those age 60 years or older is increasing. The proportion of the population in the working ages (15-59) has been more or less constant, but that too will decline over time.

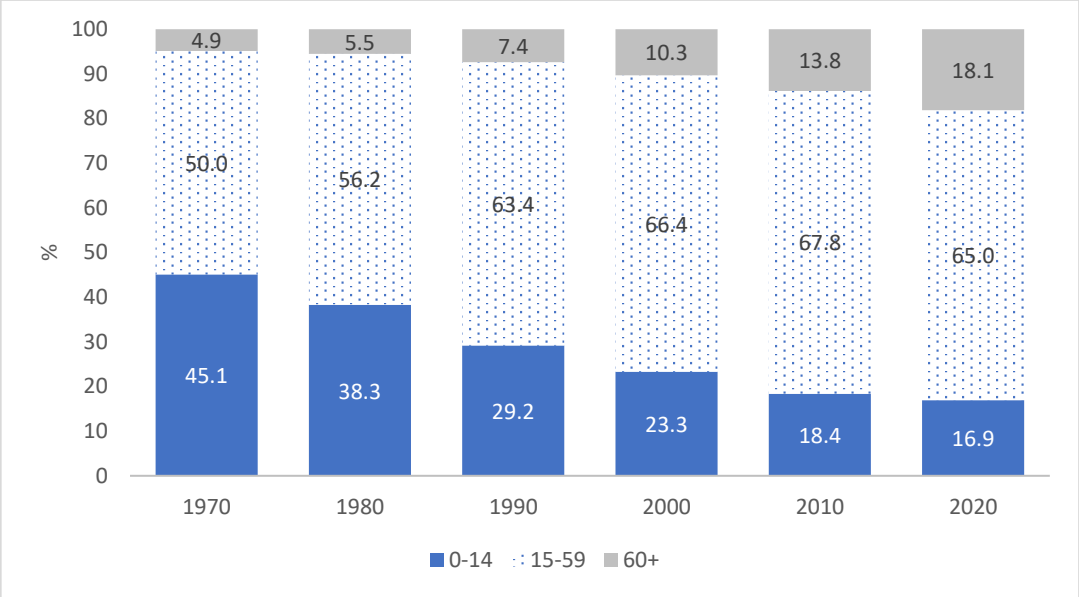


Figure 2.1: Proportion of the population by age group: 1970 - 2020

Source of data: 1) National Population and Housing Census: 1970, 1980, 1990, 2000, 2010, National Statistical Office.

2) Population projections for Thailand 2010-2040 (revised version), Office the National Economic and Social Development Board

Population pyramids graphically show the age-sex structure of the population by age group. Each horizontal bar represents a 5-year age group and is arranged from lowest to highest age. The bar graph shows the age of the male population to the left and the female population is on the right.

When comparing the Thai population pyramid from 1970, 1980, 1990, 2000, 2010 to the present (2020), it can be seen that, in 1970, the Thai population had a broad base and a narrow apex, which resulted from historically high fertility and mortality. By 1980, however, the base of the pyramid starts to narrow, which reflects the declining birth rates in the previous decade. In addition, the top of the pyramid is starting to flatten due to improved health interventions for older persons. From then on, the top and base of the pyramid are approaching equal size because of the continued decline of births and older-age deaths.

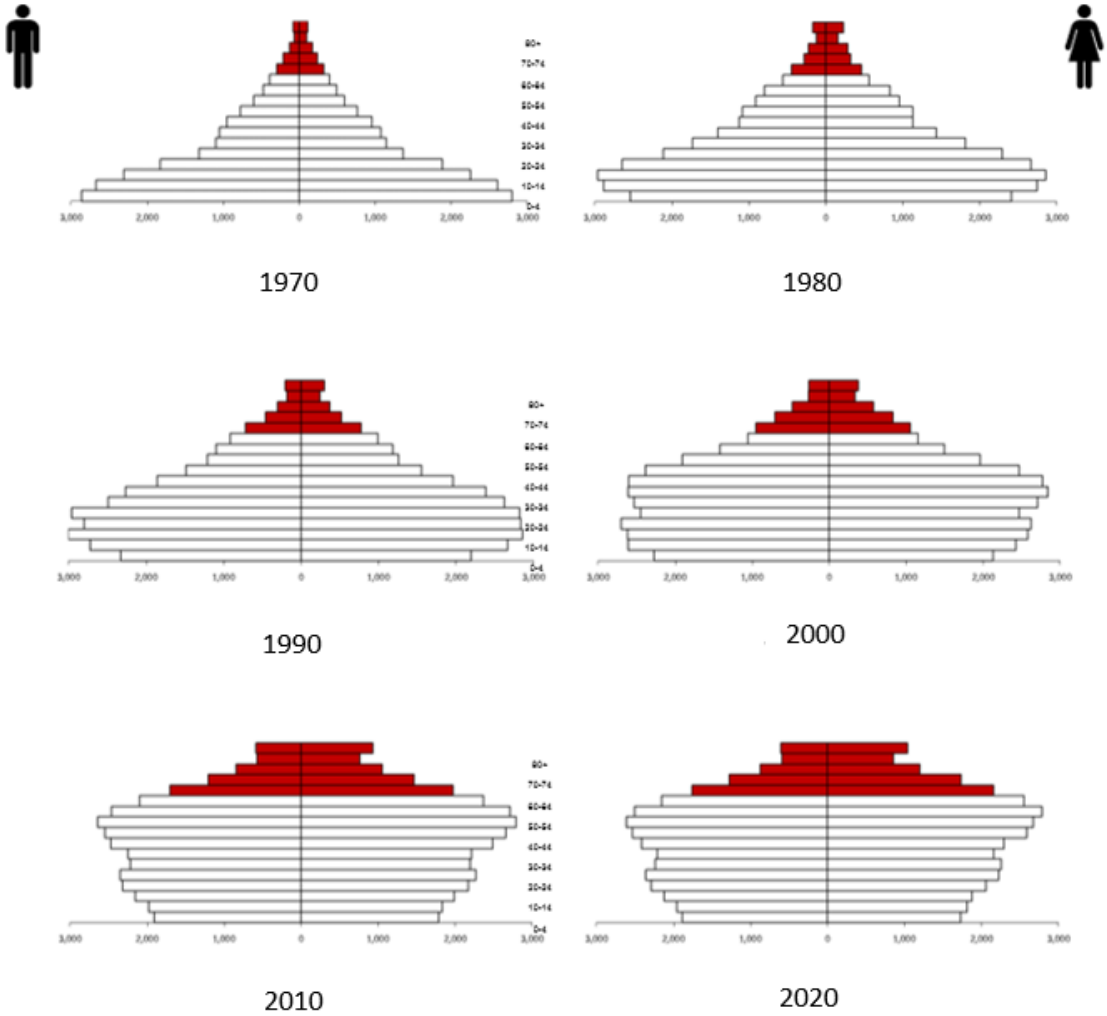


Figure 2.2: Thai population pyramids: 1970, 1980, 1990, 2000, 2010 and 2020

Source of data*:* 1) National Population and Housing Census: 1970, 1980, 1990, 2000, 2010, National Statistical Office.

2) Population projections for Thailand 2010-2040 (revised version), Office the National Economic and Social Development Board

2.1.2 Proportion of the population that is elderly

As noted, the proportion of the Thai population that is elderly has increased for every year of the Thai Census since 1970. When looking at the elderly in three sub-groups (young: 60-69, older: 70-79, and oldest: 80 years or older) it can be seen that the oldest group of the population has had the largest proportion shift over the decades (Figure 2.3).

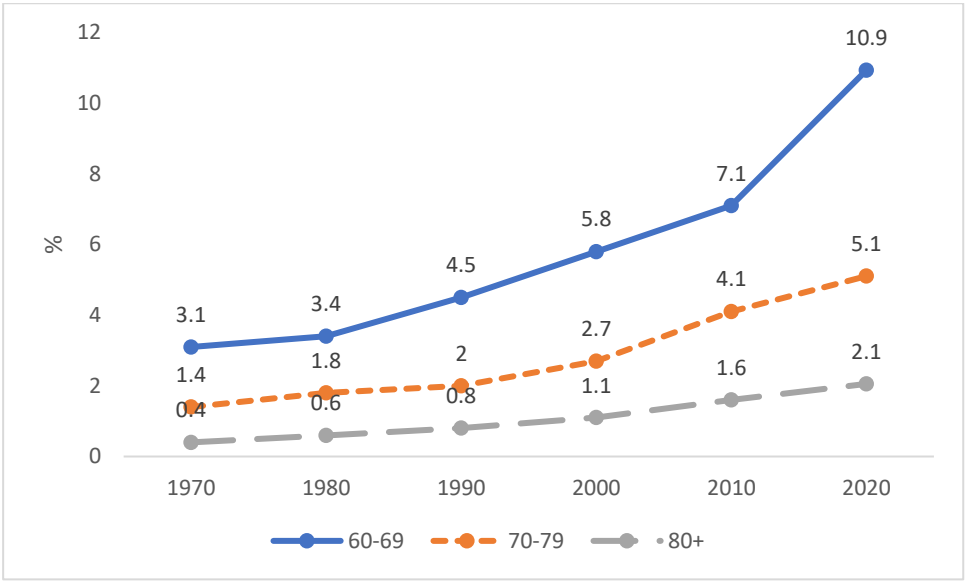


Figure 2.3: Proportion of the elderly population classified by three age groups, 1970-2020

Source of data: 1) National Population and Housing Census: 1970, 1980, 1990, 2000, 2010, National Statistical Office.

2) Population projections for Thailand 2010-2040 (revised version), Office the National Economic and Social Development Board

In addition, in the older Thai age groups, women tend to outnumber men, and that is true for all age groups of the elderly. This sex differential is showing a tendency to increase. While the rate of increase of the elderly population was from 4.5% in 1970 to 13.6% in 2013, the corresponding increase in elderly women was from 5.3% in 1970 to 15.8% in 2013.

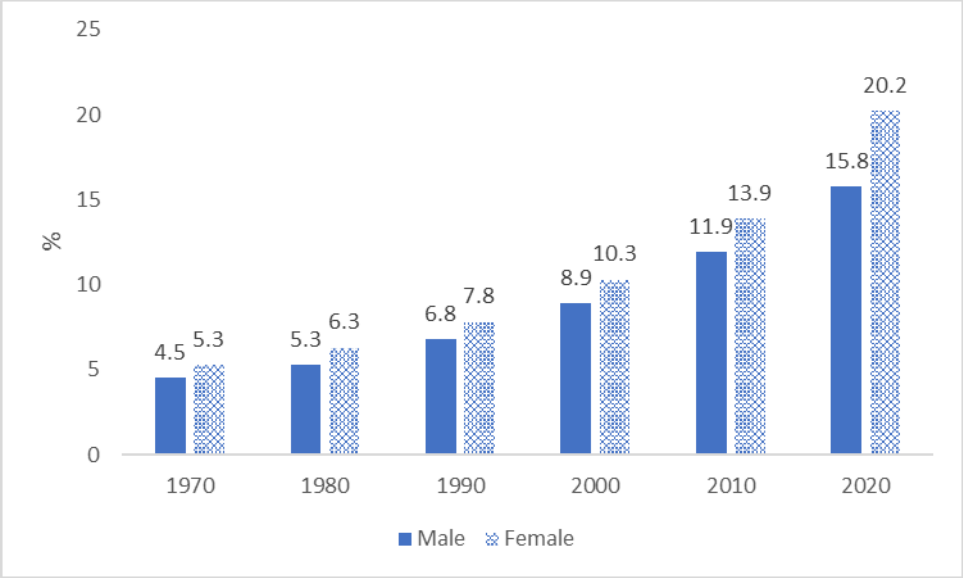


Figure 2.4: Proportion of the elderly population by sex: 1970-2020

Source of data: 1) National Population and Housing Census: 1970, 1980, 1990, 2000, 2010, National Statistical Office.

2) Population projections for Thailand 2010-2040 (revised version), Office the National Economic and Social Development Board

2.2 Life expectancy of the Thai population

Life expectancy at birth refers to the estimate of how long a person at birth will survive. The aging population is due to births decline and people live longer

The life expectancy at birth of the global population in 2019 was approximately 73 years, with males equal to 70 years and females equal to 75 years (United Nations, 2019). A half-century ago, life expectancy at birth of the Thai population was 50 years, but has now has increased to the extent that life expectancy at birth is 80 years for females and 73 years for males (Institute for Population and Social Research, 2562) (Figure 2.5). For Japan, which is considered to be the country with the highest longevity of the population in the world, the life expectancy at birth is, on average 84 years, with males equal to 81 years and females equal to 87 years (Table 2.1).

Table 2.1: Life expectancy at birth: The world, Thailand and Japan in 2019

	Male	Female	Total
Global	70	75	73
Thailand	73	80	76
Japan	81	87	84

Source of data*:* World Population Prospects 2019, United Nations

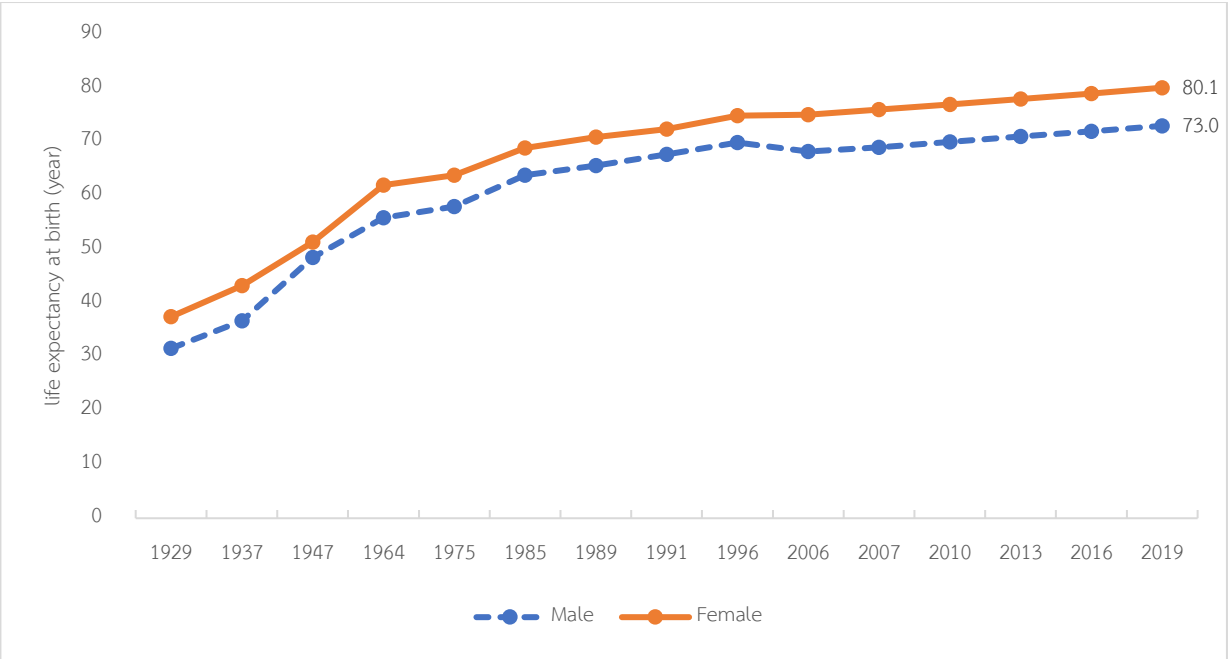


Figure 2.5: Life expectancy at birth of the Thai population

Sources of data: 1. Prasartkul, P. (2013, April). Population aging and health: a case study of Thailand. Keynote lecture presented at the RGJ-PhD Congress XIV, Chonburi, Thailand. Institute for Population and Social Research Publication No. 416, 2013.

2. 2019, estimated by Institute for Population and Social Research Mahidol University

At the same time, age-specific life expectancy at age 60 and 80 (Table 2.2) also increased in 2019. The male population age 60 and 80 are projected to live, on average, another 17 years and 6 years, respectively, for females, the corresponding figures are 23 years and 8 years, respectively (Institute for Population and Social Research, 2019). However, as the world advances in medicine, public health, technology, urbanization, and improved quality of life, longevity can be expected to increase even further.

Table 2.2: Thai life expectancy at birth, age 60 and 80 years in 2019

Life expectancy (years)	Males	Females
life expectancy at birth	73.0	80.1
life expectancy at age 60	**17.1**	**22.8**
life expectancy at age 80	6.0	8.3

Source of data: Mahidol Population Gazette, Institute for Population and Social Research, 2020

2.3 Healthy aging

Good health is the foundation of a strong body and mind. Healthy aging refers to a process whereby an individual or groups of people in society age while maintaining sound mind and body. One indicator of healthy aging is "healthy life expectancy," which is defined as the period of life in which one can expect to be autonomous for ADLs; i.e., does not have to depend on others for conducting ADLs (Institute for Population and Social Research, 2015).

Healthy life expectancy is a subset of the regular life expectancy calculation by deducting unhealthy life-years to determine the projected duration of healthy life of the population. In general, females have a greater life expectancy at birth, and at ages 60-65 years, than males. However, females are also likely to accumulate more years of ill health than males. That difference is reflected by comparing the life expectancy at birth and healthy life expectancy.

Healthy life expectancy of the global population in 2016 was around 63 years (62 years for males and 65 years for females) (United Nations, 2019). For Thailand, healthy life expectancy of the population is not that different from the global level, i.e., healthy life expectancy of the Thai population is about 67 years, with females equal to 70 years and males equal to 64 years. In Japan, healthy life expectancy was 75 years overall, and 73 years for males and 77 years for females (Table 2.3).

Table 2.3: Healthy life expectancy: The world, Thailand and Japan, 2019 (years)

	Male	Female	Total
Global	62.0	64.8	63.3
Thailand	64.0	69.8	66.8
Japan	72.6	76.9	74.8

Source of data: WHO, 2016

Thus, even though females tend to have greater longevity than males based on the raw life expectancy at birth, the gender gap narrows when considering healthy life expectancy. This pattern was documented in a study among countries in Europe (Carol Jagger, 2015), and South Korea (Jin Yong Lee, 2016; Joshua A Salomon et.al (2012)

Self-rated health is commonly used as an indicator to calculate healthy life expectancy among the elderly. Data from the 2017 Survey of Older Persons by the National Statistical Office found that more male seniors reported that they felt they were in 'good' or 'excellent' health than their female counterparts, and this finding was similar across multiple rounds of the survey. In addition, more of the young-elderly evaluated their health status as 'good' than their oldest-elderly counterparts. Academic studies in many countries have similar results as in Thailand (Josefsson, Andersson, & Erikstedt, 2016; Singh, Arokiasamy, Singh & Rai, 2013; Yong, Saito, & Chan, 2011).

Table 2.4: Overall health of the elderly population by sex and age group, 2017

	Overall health status (self-rated)				
	Excellent	Good	Moderate	Poor	Very bad
Total	2.4	39.3	43.2	13.5	1.6
Males	3.1	43.4	40.3	11.7	1.5
Females	1.8	36.0	45.6	14.9	1.7
Age group					
60-69 years	3.1	48.2	39.2	8.7	0.8
70-79 years	1.5	31.1	49.2	16.4	1.8
80 years or older	1.2	19.7	47.2	27.3	4.6

Source of data: Survey of the Older Persons, 2017, National Statistical Office

2.4 Long Term Care (LTC)

The very rapid increase in the proportion of the Thai population that is elderly is not giving the country much time to prepare for the anticipated increase in chronic illness/conditions and disability that inevitably come with advanced age. Aging is usually accompanied by a decline in function of the body's vital organs, most importantly the brain. Regressive aging naturally results in an increase in the number of elderly who are dependent on others for ADLs, and these persons will need care/assistance from people in the family or care providers. This is exacerbated by the fact that the capacity of the family in providing care for elderly members of the household is also declining due to shrinking family/household size.

The above situation has led to a rush of many localities to begin developing community-based care systems through the cooperation of the local public health team, local agencies, and Civil Society to assist the elderly and dependent members of the community. Long-term care (LTC) is one of the policies that the MOPH has developed to improve the system of assistance for the elderly and dependent members of society, whether in bed, the home, or in the community at-large. One strategy of this policy is how to prevent healthy seniors from becoming ill and then dependent for care and functioning. A corollary strategy is how to give the most appropriate and optimal care for those who do become dependent. The Thai government has allocated a budget for LTC for dependent elderly under the National Health Security Office (NHSO) Universal Health Coverage (UHC) scheme. These funds were then allocated to the service outlets and local administrative organizations (LAO), starting in Fiscal Year to augment hospital care. The MOPH has also organized cadres of 'Family Health Teams' in cooperation with the LAO, to screen the elderly using ADLs indicators (Barthel ADLs index). Initial screening can be carried out by local village health volunteers (VHV) or caregivers of the elderly. That screening provides a more objective way to assess the care burden (National Health Security Office, 2016).

Older persons are classified into 3 groups based on the scores of Barthel Index are the following;

- Persons who are generally self-reliant and can help others in the community and society are those with an ADLs Index score of 12 or more points out of 20 (for physical ability) and a score of 5 or more points out of 8 for cognitive ability.
- Home-bound seniors include elderly who able to move around the household and help themselves with some ADLs. This refers to persons who score in the range 5-11 / 20 points and a total score of cognitive ability of less than 5/8 points.
- The bed-ridden seniors is a group that is almost totally dependent on others, cannot move easily without assistance, or are otherwise disabled. The persons in this category have a total score of physical ability in the range 0-4 / 20 points and low score of cognitive ability, i.e., below 5/8 points.

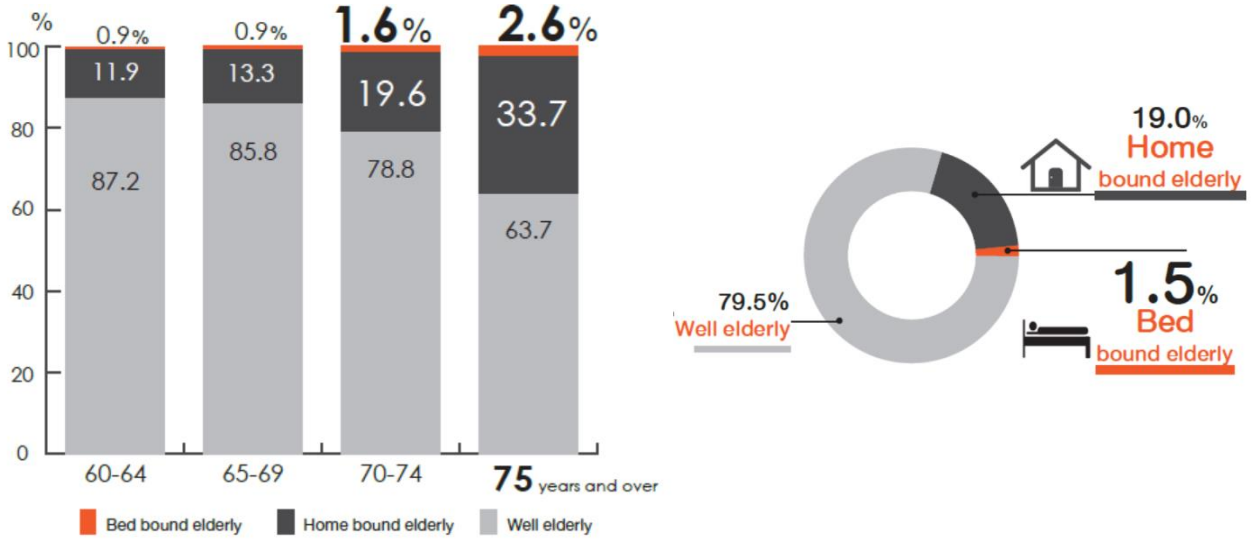


Figure 2.6: Ability of Thais to perform activities in daily living (ADLS) by age group, 2013

Source of data: 2013 Thai Elderly Health Survey under the Health Promotion Program for the Elderly and the Disabled, Elderly Health Work Cluster, Office of Health Promotion, Department of Health, MOPH

It can be seen in Figure 2.6 that the majority of the elderly (about 80 percent) are self-reliant for ADLs. At the same time, another 19 percent of the elderly are home-bound, while the remainder are bed-ridden.

Proportionately, however, there is a trend for Thai elderly to be more home-bound or bed-ridden, probability due to the prevalence of more life-extending medical interventions. As noted, it is important to screen senior citizens on a regular basis for self-sufficiency in ADLs, level of dependency on others, as well as need for health care and social services. As a standard guideline, there should be one care manager per 5-8 care givers, and one caregiver per one home-bound, bed-ridden elderly. In general, a community care manager can oversee the care for 35-40 seniors. The duties of the manager include producing care plans and mentoring the caregivers (Thai Gerontological Research and Development Institute Foundation, 2017).

In addition, in 2015, the MOPH formulated a policy of primary health care reform to ensure closer health care and health promotion through the project called "Primary Care Cluster." The cluster approach is a holistic strategy with the concept of service for everyone, anywhere, anytime, and supported by technology. There are "Family Health Teams," and coverage of the project is supposed to be nationwide. Key services include health counseling at the home if needed, and referral to a family medicine specialist or interdisciplinary medicine practitioner (MOPH, n.d.). Unfortunately, the demographic data at present predict -- with near mathematical certainty -- that, in the near future, Thailand will have many more elderly people who will be dependent on others for ADLs, and the need for LTC is bound to increase just as rapidly as the growth of the elderly population.

2.5 Evaluation form for ADLs used by the Ministry of Public Health (MOPH)

The ADLs assessment form documents ability of older persons to perform activities in daily life (Barthel Activities of Daily Living: ADLs)

Definition of terms

Elderly are classified according to the Barthel ADLsIndex (BI) to assess need for long-term health promotion. The Department of Health of the MOPH, together with network partners and experts, applies the criteria for assessing the ability to perform ADLs using the Barthel index, which has a full score of 20 points as follows:

Group 1: The elderly who are independent, and can help others in the community and society (self-reliant): BI score of 12-20;

Group 2: The elderly who can manage some ADLs by themselves but generally have to stay in/around the household (home-bound) BI score of 5 - 11 points;

Group 3: The elderly who are dependent on others, disabled, or bed-ridden: BI score of 0-4 points.

Ability to perform ADLs: The Barthel ADLs Index (BI)

1. **Feeding** (eating when food/meal is placed in front of them)

☐0. Must be spoon-fed

☐1. Can spoon feed by self, but need someone to help, such as cutting food into small pieces

☐2. Can feed oneself normally

2. **Grooming** (washing face, combing hair, brushing teeth, shaving in the last 24 - 28 hours)

☐0. Need help

☐1. Can do it by self (including doing by self if implements/supplies need to be provided by someone else)

3. **Transfer** (getting to a standing position from the bed to a chair)

☐0. Cannot sit up from bed (i.e., when tries, falls back) or needs two people to help get up)

☐1. Needs a lot of help to be able to sit, for example requiring a strong or skilled person, or 2 people for support to be able to sit up

☐2. Need some help, such as instructions, slight help, or someone to observe to ensure safe standing up

☐3. Self-reliant

4. **Toilet use**

☐0. Not self-reliant

☐1. Can do by self (at least can clean by self after finishing) but needs help in some related functions

☐2. Can do by self (can sit down and stand up from the toilet by oneself; can clean properly after finishing, including removing and putting clothes back on without difficulty)

5. **Mobility** (movement within the room or home)

☐0. Can't move anywhere

☐1. Must use a self-help cart to move on their own (no need to be pushed in a wheelchair) and must be able to move into and out of a corner, room, or through a door

☐2. Can walk or move with help, such as nudging or giving instructions, or observing to ensure safety

☐3. Self-reliant

6. **Dressing** (wearing clothes)

☐0. Must be dressed by someone else; totally or mostly dependent on others to get dressed

☐1. Can dress oneself at the level of about 50 percent; help is needed to complete dressing

☐2. Can dress oneself well (including buttoning, zipping, or using suitable clothing)

7. **Stairs** (going up and down one or more stairs)

☐0. Cannot do it, even with help

☐1. Need someone to help

☐2. Self-reliant (if using a walking aid, such as a walker, it must also be taken up and down the stairs by self)

8. **Bathing**

☐0. Must have someone to help or bathe the person

☐1. Self-reliant

9. **Bowels** (holding back defecation in the past week)

☐0. Cannot hold or requires penetration of the anus to assist

☐1. Can't hold sometimes (less than 1 time per week)

☐2. Can hold back normally

10. **Bladder** (incontinence in the last week)

☐0. Cannot hold or uses a catheter, but not unassisted

☐1. Can't hold back sometimes (less than 1 time per day)

☐2. Can hold back normally

2.6 Physical ability

2.6.1 Definition of physical ability

Physical ability refers to performing routine physical activities efficiently and continuously over time without fatigue, weakness, and with expected results. The person has enough energy left over to engage in physical exertion if needed, or essential movements (e.g., in an emergency) efficiently (American College of Sports Medicine, 2006)

2.6.2 Components of physical ability

2.6.2.1 Health-related fitness or health-related components of physical fitness:

a) Cardiovascular fitness
b) Muscular strength
c) Muscular endurance
d) Body composition
e) Flexibility

2.6.2.2 Performance-related fitness or skill-related components of physical fitness

a) Agility
b) Muscular power
c) Speed
d) Balance
e) Reaction time
f) Neuromuscular coordination

2.6.3. Physical ability of the elderly

As a person gets older, physical fitness begins to deteriorate, and wear and tear and deterioration of the body increase. According to a study of de Gray ADNJ, 2007, elderly people age 60 years or over have decreased amount of oxygen in the body due to the reduced volume of cardiac output and arterial-venous oxygen differential. Moreover, aerobic capacity decreases by age, and will be below its peak level by 30% at age 65 years or older. In other words, the maximum oxygen consumption (VO2 max) decreases by 0.5% - 1.0% per year Kostic et al, 2011) and the loss of muscle mass is 12-14% (Fleg et al, 2005). This results in lower body strength, which leads to decreased balance and increased risk of falling, as well as reduced flexibility of the body as one enters advanced age. Research has shown that these declines in physical performance begin to accelerate at age 50 years along with declines in muscle mass (see Figure 2.7).

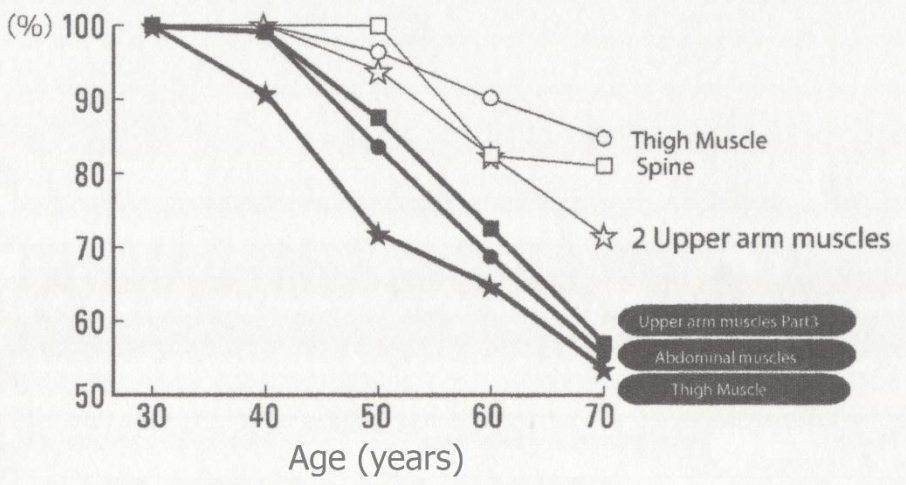


Figure 2.7: Changes in muscle mass

Source of data: Mieko Nakano and Yoshiaki Yokoyama. Self sustain movement test. Hatachi, Japan

2.6.4. Evaluation of physical ability

Rikli & Jones (1999 a, b) developed the Senior Fitness Test (SFT) or Functional Fitness Test (FFT) to screen older persons at all ages to help seniors remain self-reliant as long as possible. The test assesses the following components:

1. Lower body strength
2. Upper body strength
3. Aerobic endurance
4. Lower body flexibility
5. Upper body flexibility
6. Agility and balance

Method of applying the test

1. 30 – Second Chair Stand test

Objective: To assess lower body strength, since this is an important ability in many ADLS, such as walk up and down the stairs, walking, standing from sitting position, transportation.

Method: The person is asked to repeatedly stand up and sit down with arms folded across the chest; the number of times this is done in 30 seconds is the measurement.

Figure 2.8: 30-second chair stand test

Table 2.5: Mean scores of the 30-second chair stand test by age group and sex

Scoring of 30-second chair stand test						
Age	Men			Women		
	Below average	Average	Above average	Below average	Average	Above average
60-64	< 14	14 – 19	> 19	< 12	12 – 17	>17
65-69	< 12	12 – 18	> 18	< 11	11 – 16	> 16
70-74	< 12	12 – 17	> 17	< 10	10 - 15	> 15
75-79	< 11	11 – 17	> 17	< 10	10 – 15	> 15
80-84	< 10	10 - 15	> 15	< 9	9 – 14	> 14
85-89	< 8	8 – 14	> 14	< 8	8 - 13	> 13
90-94	< 7	7 - 12	> 12	< 4	4 - 11	> 11

Source of data:

1) Rikli RE & Jones CJ (1999). The development and validation of a afunctional fitness test for community-residing older adults. Journal of aging and physical activity.1999 a: 7: 129-161.
2) Rikli RE & Jones CJ (1999). Functional fitness normative scores for community-residing older adults, age 60-94. Journal of aging and physical activity.1999 b: 7: 162-181.

2. Arm curl test

Objective: To assess upper body strength, which is an important ability for doing housework, tending the house, and other ADLs which involve lifting, carrying, toting objects such as bags, infants/toddlers, etc.

Method: The person is instructed to sit with the upper arm firmly against the torso; the lower arm should be parallel to the floor with palms up and holding the weight. The arm is then fully raised and released (arm curl) for a period of 30 seconds. The number of successful curls is the measurement.

Figure 2.9: Arm curl test

Table 2.6: Mean scores for the arm curl test by age group and sex

Scoring arm curl test (repetition in 30 sec)						
Age	Men			Women		
	Below average	Average	Above average	Below average	Average	Above average
60-64	< 16	16 – 22	> 22	< 13	13 – 19	> 19
65-69	< 15	15 -21	> 21	< 12	12 – 18	> 18
70-74	< 14	14 – 21	> 21	< 12	12 – 17	> 17
75-79	< 13	13 – 19	> 19	< 11	11 – 17	> 17
80-84	< 13	13- 19	> 19	< 10	10 – 16	> 16
85-89	< 11	11 - 17	> 17	< 10	10 - 15	> 15
90-94	< 10	10 - 14	> 14	< 8	8 - 13	> 13

Source of data:

1) Rikli RE & Jones CJ (1999). The development and validation of a afunctional fitness test for community-residing older adults. Journal of aging and physical activity.1999 a: 7 : 129-161.
2) Rikli RE & Jones CJ (1999). Functional fitness normative scores for community-residing older adults, age 60-94. Journal of aging and physical activity.1999 b: 7: 162-181.

3. 6-minute walk test

Objective: This test is a measure of aerobic endurance, which is important in performing ADLs (walking, going up stairs, doing marketing, and going for recreational strolls.).

Method: The persons is instructed to walk in a rectangular shape in which one lap is a distance of around 50 yards or 45.7 meters. The number of laps completed in 6 minutes is the score.

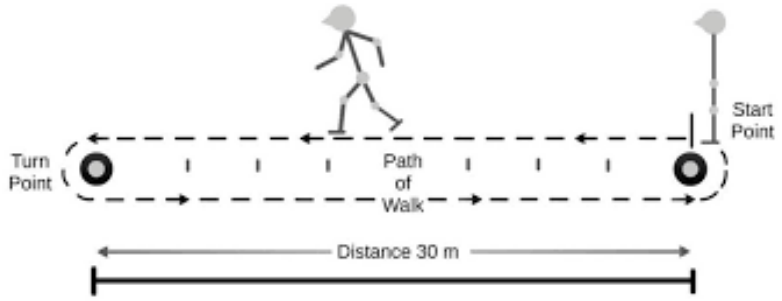


Figure 2.10: 6-minute walk test

Table 2.7: Mean scores of the 6-minute walk test by age group and sex

Scoring 6-minute walk test (meters)						
Age	Men			Women		
	Below average	Average	Above average	Below average	Average	Above average
60-64	< 612	612 – 726	> 736	< 547	547 – 659	> 659
65-69	< 562	562 -700	> 700	< 500	500 – 636	> 636
70-74	< 544	544 – 680	> 680	< 482	482 – 614	> 614
75-79	< 471	471 – 639	> 639	< 433	433 – 585	> 585
80-84	< 444	444- 604	> 604	< 384	384 – 540	> 540
85-89	< 382	382 - 572	> 572	< 340	340 - 512	> 512
90-94	< 304	304 - 502	> 502	< 273	273 - 441	> 441

Source of data:

1) Rikli RE & Jones CJ (1999). The development and validation of a afunctional fitness test for community-residing older adults. Journal of aging and physical activity.1999 a: 7 : 129-161.
2) Rikli RE & Jones CJ (1999). Functional fitness normative scores for community-residing older adults, age 60-94. Journal of aging and physical activity.1999 b: 7: 162-181.

4. 2-minute step test

Objective: This is another measurement used to obtain aerobic endurance.

Method: The person is instructed to stand with knees raised to the midway point between the patella and the top edge of the iliac crest. The number of times the knee is raised and lowered in 2 minutes is the measurement.

Figure 2.11: 2-minute step test

Table 2.8: Mean scores for the 2-minute step test by age group and sex

Scoring 2- minute step test						
Age	Men			Women		
	Below average	Average	Above average	Below average	Average	Above average
60-64	< 87	87 – 116	> 116	< 75	75 – 107	> 107
65-69	< 86	86 -115	> 115	< 73	73 – 107	> 107
70-74	< 80	80 – 110	> 110	< 68	68 – 101	> 101
75-79	< 73	73 – 109	> 109	< 68	68 – 100	> 100
80-84	< 71	71- 103	> 103	< 60	60 – 91	> 91
85-89	< 59	59 - 91	> 91	< 55	55 - 85	> 85
90-94	< 52	52 - 86	> 86	< 44	44 - 72	> 72

Source of data:

1) Rikli RE & Jones CJ (1999). The development and validation of a afunctional fitness test for community-residing older adults. Journal of aging and physical activity.1999 a: 7 : 129-161.
2) Rikli RE & Jones CJ (1999). Functional fitness normative scores for community-residing older adults, age 60-94. Journal of aging and physical activity.1999 b: 7: 162-181.

5. Chair Sit and Reach test

Objective: This testis to assess lower-body flexibility, which is very important for balance, normal walking, and movement, e.g., getting up and down in a bathroom, from a boat or car.

Method: The persons is instructed to sit in a chair, lean forward, with one leg fully outstretched, and gradually extend the fingers to touch the toes. If the tip of the fingers cannot reach the toes, then the distance between the fingertip and toes is a negative value (i.e., inches). If the fingertips reach and exceed the toes, then the distance beyond the toes is a positive value.

Figure 2.12: Chair Sit and Reach test

Table 2.9: Mean scores of the Chair – Sit – and – Reach by age group and sex

Scoring chair sit and reach test (inches)						
Age	Men			Women		
	Below average	Average	Above average	Below average	Average	Above average
60-64	< -2.5	-2.5 to 4.0	> 4.0	< -0.5	-0.5 to 5.0	> 5.0
65-69	< -3.0	-3.0 to 3.0	> 3.0	< -0.5	-0.5 to 4.5	> 4.5
70-74	< -3.5	-3.5 to 2.5	> 2.5	< -1.0	-1.0 to 4.0	> 4.0
75-79	< -4.0	-4.0 to 2.0	> 2.0	< -1.5	-1.5 to 3.5	> 3.5
80-84	< -5.5	-5.5 to 1.5	> 1.5	< -2.0	2.0 to 3.0	> 3.0
85-89	< -5.5	-5.5 to 0.5	> 0.5	< -2.5	-2.5 to 2.5	> 2.5
90-94	< 6.5	-6.5 to 0.5	> 0.5	< 4.5	-4.5 to 1.0	> 1.0

Source of data:

1) Rikli RE & Jones CJ (1999). The development and validation of a afunctional fitness test for community-residing older adults. Journal of aging and physical activity.1999 a: 7 : 129-161.
2) Rikli RE & Jones CJ (1999). Functional fitness normative scores for community-residing older adults, age 60-94. Journal of aging and physical activity.1999 b: 7: 162-181.

6. Back scratch test

Objective: To assess upper body flexibility, which is important for general movement and preventing accidents.

Method: Instruct the person to stand in a normal position, and lift the dominant arm above the head and reach behind the same shoulder. Then reach with the other arm around the back to try to touch the fingers of the dominant arm. The score is the distance between the outstretched palms (assuming there is a gap). The person should be allowed two practice attempts before the actual measurement. The person should conduct the reach twice, with the best value (least gap) being recorded.

Figure 2.13: Back scratch test

Table 2.10: Mean scores of the back scratch test by age group and sex

Scoring back scratch test (inches)						
Age	Men			Women		
	Below average	Average	Above average	Below average	Average	Above average
60-64	< -6.5	-6.5 to 0	> 0	< -3.0	-3.0 to 1.5	> 1.5
65-69	< -7.5	-7.5 to -1.0	> -1.0	< -3.5	-3.5 to 1.5	> 1.5
70-74	< -8.0	-8.0 to -1.0	> -1.0	< -4.0	-4.0 to 1.0	> 1.0
75-79	< -9.0	-9.0 to -2.0	> -2.0	< -5.0	-5.0 to 0.5	> 0.5
80-84	< -9.5	-9.5 to -2.0	> -2.0	< -5.5	-5.5 to 0	> 0
85-89	< -10.0	-10.0 to -3.0	> -3.0	< -7.0	-7.0to -1.0	> -1.0
90-94	< -10.5	-10.5 to -4.0	> -4.0	< -8.0	-8.0to -1.0	> -1.0

Source of data:

1) Rikli RE & Jones CJ (1999). The development and validation of a afunctional fitness test for community-residing older adults. Journal of aging and physical activity.1999 a: 7 : 129-161.
2) Rikli RE & Jones CJ (1999). Functional fitness normative scores for community-residing older adults, age 60-94. Journal of aging and physical activity.1999 b: 7: 162-181.

7. 8 - foot up and go test

Objective: To assess balance and agility, which are important for general movement and preventing accidents

Method: Place a chair against the wall facing a cone placed on the floor which is 8 feet away from the edge of the chair. Instruct the person to sit on the chair with feet flat on the ground and hands palms-down on the thighs. At the "start" signal, the person is to stand up walk as quickly as possible around the cone and return to the chair. The measurement is the number of seconds it takes to complete one lap. Have the person do this twice and record the best value.

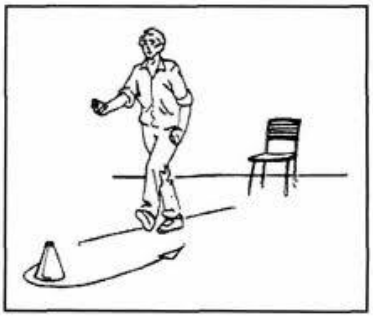


Figure 2.14: 8 foot up and go test

Table 2.11: Mean scores of the 8 foot up and go test by age group and sex

Scoring 8 foot up and go test (seconds)						
Age	Men			Women		
	Below average	Average	Age	Below average	Average	Age
60-64	> 5.6	5.6 – 3.8	< 3.8	> 6.0	6.0 – 4.4	< 4.4
65-69	> 5.7	5.7 - 4.3	< 4.3	> 6.4	6.4 – 4.8	< 4.8
70-74	> 6.0	6.0 – 4.2	< 4.2	> 7.1	7.1 – 4.9	< 4.9
75-79	> 7.2	7.2 – 4.6	< 4.6	> 7.4	7.4 – 5.2	< 5.2
80-84	> 7.6	7.6 - 5.2	< 5.2	> 8.7	8.7 – 5.7	< 5.7
85-89	> 8.9	8.9 – 5.3	< 5.3	> 9.6	9.6 – 6.2	< 6.2
90-94	> 10.0	10.0 – 6.2	< 6.2	> 11.5	11.5 – 7.3	< 7.3

Source of data:

1) Rikli RE & Jones CJ (1999). The development and validation of a afunctional fitness test for community-residing older adults. Journal of aging and physical activity.1999 a: 7 : 129-161.
2) Rikli RE & Jones CJ (1999). Functional fitness normative scores for community-residing older adults, age 60-94. Journal of aging and physical activity.1999 b: 7: 162-181.

2.6.5 The “Self-Sustained Movement” program of Japan

As noted, Japan has one of the most rapidly-aging societies in the world. Among many different impacts, this demographic phenomenon is straining the government budget to insure health care of seniors. Therefore, in 2006, Profs. Nakano Mieko and Yokoyama Yoshiaki of Shizuoka University, Japan designed a research project so assess to what extent the Japanese elderly could be helped to be more self-reliant. The intervention includes a basic exercise regimen by using the principle of self-movement training, once a week, 15 minutes per day, for 3 months. The initial study was conducted with 28 participants, and only 10 persons from the results participated to train over 3 consecutive months (two persons age 60-65years, two persons age 70-74years, four persons age 80-84 years, and two persons age 85 years or older). According to the test results at 3 months, the participants had statistically significant improvement in basic movement 4 (Figure 2.15)

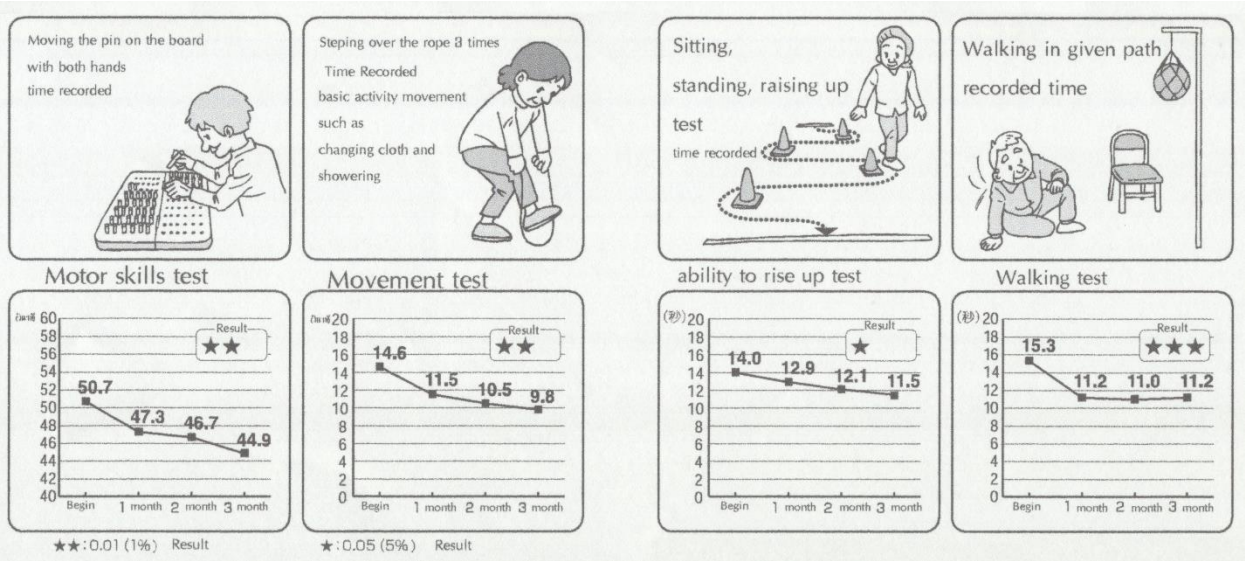


Figure 2.15: Results of tests of manual dexterity, body movement, walking, and changing posture

Source of data: Mieko Nakano and Yoshiaki Yokoyama. Self sustain movement test. Hatachi, Japan

2.6.5.1 Principles behind the benefit of Self-Sustained Movement program for the elderly

1. Exercise training program: The exercise training is designed to focus on the chest, abdomen, and lower muscles to maintain performing ADLs independently and prevent becoming bed-ridden;

2. Safety consideration: The program should be halted in the safety conditions, the elderly should not have any history or occurrence of illness, injury, high blood pressure, palpitations, fever or body abnormalities or symptoms of pain or abnormalities;

3. Start slowly: The program should be started with a low intensity and then slowly increase when the elderly feels comfortable with the exercise program and not unduly tired. After 4 weeks, increase the number of repetitions, and practice the correct posture. The weights can be increased for the exercises with weights;

4. The program should begin with a warm-up and finish with do cool-down.

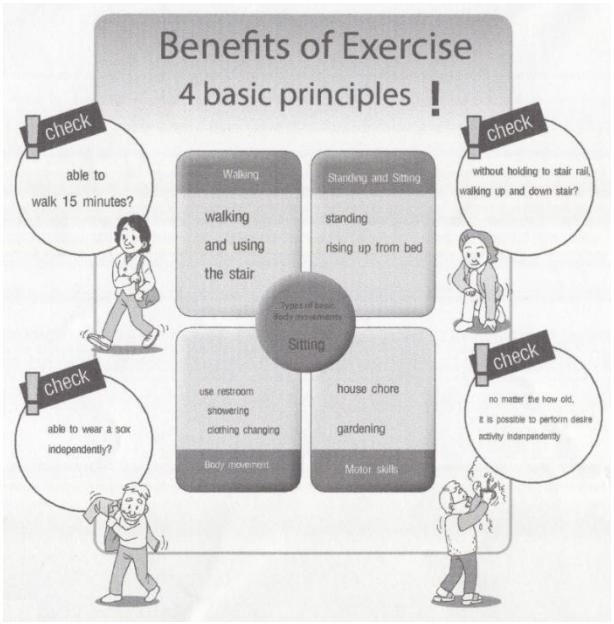


Figure 2.16: Benefits of the SSM program

Source of data: Mieko Nakano and Yoshiaki Yokoyama. Self-sustained movement test. Hatachi, Japan

2.6.5.2 Principles of muscle training

SSM training is important for the following muscle groups:

a) Muscles in the core of the body, namely the thigh muscles (front), the abdominal muscles, and waist muscles that are used in bending or leaning;

b) Muscles in the thigh-knee area -- such as the front and back leg muscles -- help in balance and walking, especially in persons with osteoarthritis who may have difficulty standing, sitting, walking, running or climbing stairs;

c) The thigh, knee, and calf muscles are the muscles that help control the front ankle to help in balance, walking, and ankle movement. If this muscle is not strong, there will be abnormal walking movement;

d) The interior muscles in/around the groin area, lumbar muscles, and the back muscles are important for balance; if these muscles are weak, the person will be prone to accidental falls;

e) The muscles that are associated with the elbow joint e.g., forearm, front, and back of the arm, help in lifting and supporting the body, and facilitate getting up from a bed or chair, and preventing falls;

f) Muscles that help control the finger joints, including the palm muscles, help the hands grip firmly.

2.6.5.3 Self-Sustained Movement (SSM) training from Mieko Nakano and Yoshiaki Yokoyama. Self-sustained movement test. Hatachi, Japan

1. The SSM program has seven basic postures or positions: 1) stepping in place (marching), 2) knee-bends (squatting), 3) stepping forward (front lunge), 4) stepping in place (marching), 5) sit-ups (abdominal crunch), 6) push-ups, and 7) stepping in place (marching) (see figure 2.17):

Figure 2.17: Basic physical exercises in the SSM

2. To develop the muscles in particular, the SSM has seven postures: 1) stretching/bending the knee, 2) squeezing a ball, 3) hand and finger squeeze, 4) stepping in place (marching), 5) walk across a resistance band, 6) stretch/bending the elbow, and 7) stepping in place (marching) (see figure 2.18):

Figure 2.18: Basic exercises for muscle development

If the person cannot stand easily (or at all), then the exercises can be done in a sitting position (see figure 2.19)

Figure 2.19: Basic physical exercise and muscle training (sitting position training)

To increase the intensity in exercise, increase the number of repetitions. (Standing position training) as shown in Table 2.12 and Table 2.13

Table 2.12: Summery of exercise intensity for SSM training (Basic physical exercise training) while standing.

Basic training	**Marching**	**Squatting**	**Front lunge**	**Marching**	**Abdominal crunch**	**Push up**	**Marching**
1st-3rd train	10 times	3 times	2 times	10 times	2 times	5 times	10 times
4th-5th train	15 times	3 times	2 times	15 times	3 times	5 times	15 times
6th train	30 times	5 times	3 times	30 times	5 times	10 times	30 times

Table 2.13: Summery of exercise intensity for SSM training (Muscle training) while standing.

Muscle training	Knee stretching	Ball squeezing	Hand and finger	Marching	Resistance band	Arm Stretching	Marching
1st-3rd train	5 times	5 times	10 times	10 times	3 times	5 times	10 times
4th-5th train	8 times	8 times	10 times	15 times	3 times	8 times	15 times
6th train	10 times	10 times	10 times	30 times	5 times	10 times	30 times

To increase the intensity in exercise, increase the number of repetitions. (Sitting position training) as shown in Table 2.14 and Table 2.15

Table 2.14: Summery of exercise intensity for SSM training (Basic physical exercise training) while sitting.

Basic training	Marching	Squatting	Front lunge	Marching	Abdominal crunch	Push up	Marching
1st-3rd train	10 times	3 times	4 times	10 times	4 times	5 times	10 times
4th-5th train	15 times	3 times	4 times	15 times	6 times	5 times	15 times
6th train	30 times	5 times	6 times	30 times	10 times	10 times	30 times

Table 2.15: Summery of exercise intensity for SSM training (Muscle training) while sitting

Muscle training	Knee stretching	Ball squeezing	Hand and finger	Marching	Resistance band	Arm Stretching	Marching
1st-3rd train	5 times	5 times	10 times	10 times	6 times	5 times	10 times
4th-5th train	8 times	8 times	10 times	15 times	6 times	8 times	15 times
6th train	10 times	10 times	10 times	30 times	10 times	10 times	30 times

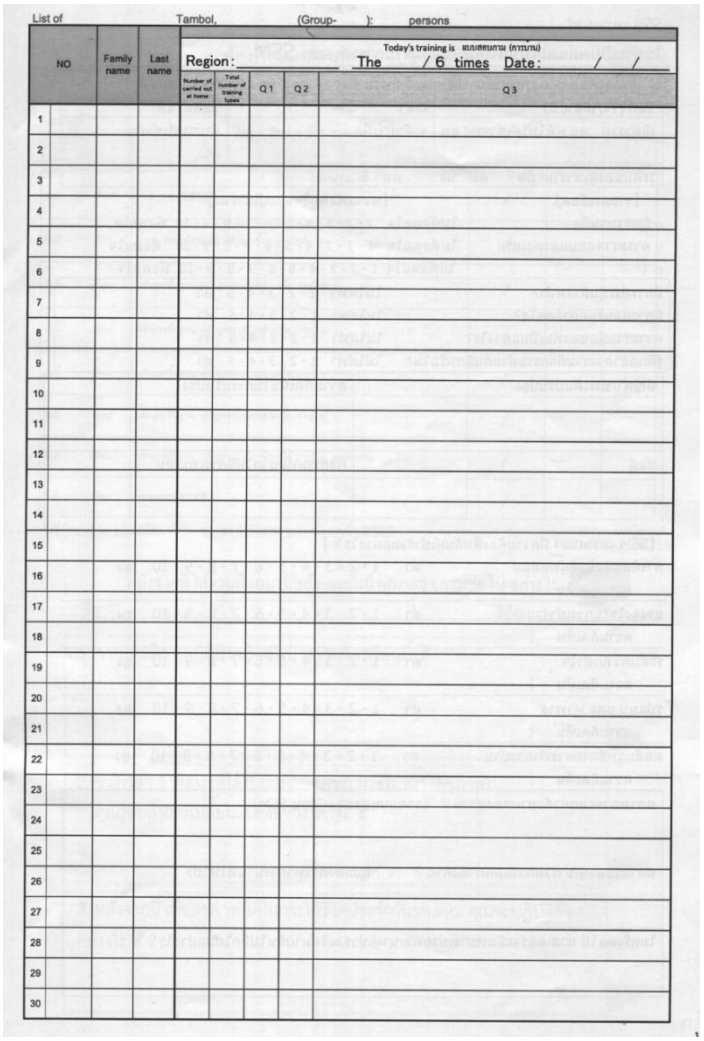
The self-sustained movement program includes an assessment form to be used at home (Table 2.16).

Table 2.16: Questionnaire (for home application of the SSM program)

Q1	How difficult or easy was the SSM program	1. easy 2. moderate 3. difficult
Q2	After doing the SSM program, did you feel any change as a result (physical, feeling, other)?	1. yes 2. no
Q3	If you answered “yes” to Q2, please describe the change you felt	(open-ended)

The process of questionnaire recording for the elder when perform exercise at home

1. Record the total number of times doing the exercises at home
(For example, there are 7 basic exercise types: if 6 types are done twice, then record 12 times)
2. Ask questions from the questionnaire as in Q1, Q2, Q3. Record scores in the exercise form
3. Sign in the home exercise form
4. Compile the results of the home-based exercises into a file



List of Tambol, (Group-): persons

NO	Family name	Last name	Region: Today's training is ... The / 6 times Date: / /				
			Number of carried out at home	Total number of training types	Q1	Q2	Q3
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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27							
28							
29							
30							

Figure 2.20: Exercise record form (for home application of the SSM)

2.6.5.4. The SSM assessments

There are four physical ability used to assess the outcomes of SSM training program:

1. Walking
2. Movement
3. Manual dexterity
4. Postural change ability

1.Walking ability

Activity: Walk around the cone set for a distance of 7 meters and time one lap.

Equipment needed: Stopwatch, cone, tape measure, masking tape for marking lines

1.1 Test preparation

1.1.1. Use tape to indicate starting point; then extend a line of tape 7 meters long (see figure below)

1.1.2. From the center line, measure (left-right) 50 cm on each side from the starting point.

2 meters to the left, place cone #1

4 meters to the right, place the cone #2

6 meters on the left, place cone #3

Place the 4th cone at the center line at 7 meters

1.1.3. Draw an arrow pointing at the direction of the periphery of the cone # 1, 2, 3 and then circle around the 4th cone

1.2 Method of assessment

1.2.1. Walk from the start point to “slalom” around cones # 1, 2, 3 and 4

1.2.2. Then walk along the center line

1.2.3. Complete the lap by walking along the center line to the starting point

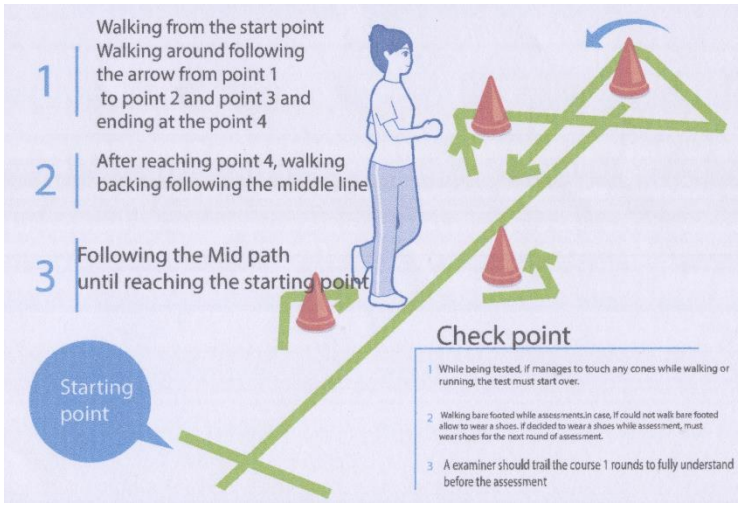


Figure 2.21: Walking test

Source of data: Mieko Nakano and Yoshiaki Yokoyama. Self-sustained movement test. Hatachi, Japan

1.3 Method of recording results

1.3.1 Time the person to complete one lap

1.3.2. Compute time in rounded seconds

1.3.3. Do the exercise twice; rest in between the two tests; and record both required times

2. Movement ability

Activity: Use the elastic band to stretch the arms, and time it

Equipment needed: stopwatch and rubber stretch band

2.1 Preparation

2.1.1. Prepare rubber stretch bands of three sizes (120 cm, 100 cm, 80 cm)

2.1.2. Stretch the band as far as possible (see figure below)

2.2 Method of assessment

2.2.1. Choose the band of appropriate size. Grasp the elastic band with both hands and stretch arms as wide as possible

2.2.2. Leaning forward, let the rubber band to touch the floor; step over the band elastic, one foot at a time; stretch the band behind the body, with arms on both sides and above the head.

2.2.3. Stand upright with arms above the head and arms extended to the front.

2.2.4. Then complete Steps 2 and 3 over three repetitions (person can lean forward)

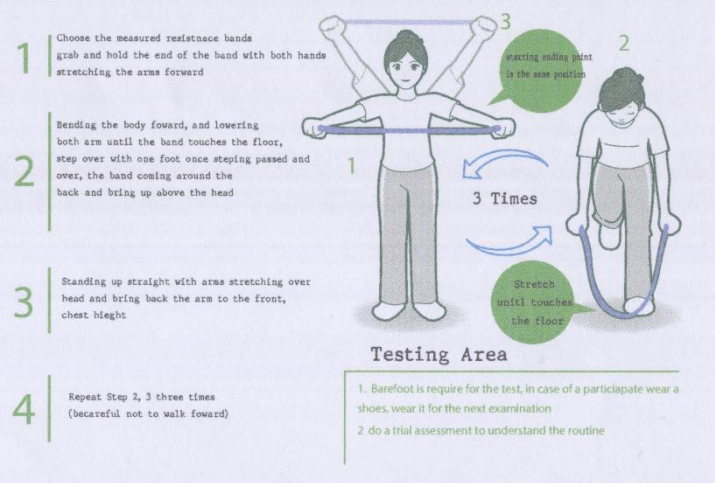


Figure 2.22: Body movement test

Source of data: Mieko Nakano and Yoshiaki Yokoyama. Self-sustained movement test. Hatachi, Japan

2.3 Method of recording results

2.3.1. Measure time it takes to complete three rounds

2.3.2 Time is measured in rounded seconds

2.3.3. Do the exercise twice; rest in between the two tests; and record both required times

3. Manual dexterity

Activity: Use both hands to move pegs on a peg board from one end to the middle; with timing

Equipment needed: Stopwatch, peg board with pegs, table

3.1 Preparation

3.1.1 Set up a sturdy table

3.1.2. Place the pegs on either side of the board in two rows (see figure)

3.2 Method of assessment

3.2.1. Both hands move pegs from the middle to the edge of the board, start from the most far pegs

3.2.2. Start with only one hand (either right or left first) move pegs from the edge to the middle of the board, start with from most far peg.

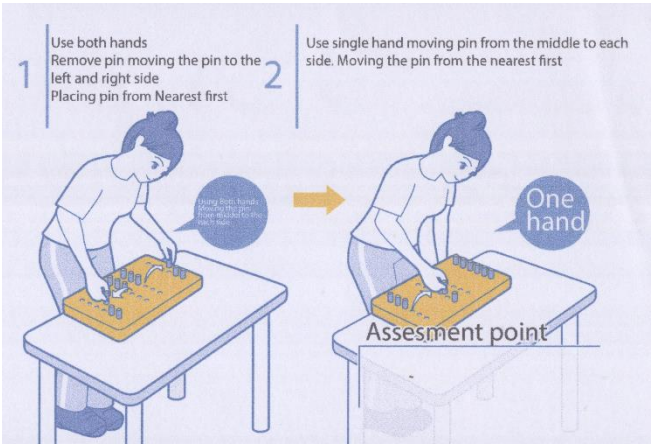


Figure 2.23: Manual dexterity test

Source of data: Mieko Nakano and Yoshiaki Yokoyama. Self-sustained movement test. Hatachi, Japan

3.3 Method of recording results

3.3.1. Measure the time it takes to move all pegs to the middle and back

3.3.2. Measure time in rounded seconds

3.3.3. Do the exercise twice; rest in between the two tests; and record both required times

4. Postural change ability

Activity: Test movement from lying flat, to sitting in a chair, then stooping to pick up a ring and place it over the head (see figure below); time one round

Equipment needed: Stopwatch, tape measure, floor mat, ring, and chair

4.1. Preparation

4.1.1. Use masking tape to delineate a 1 sq. m frame

4.1.2. Lay the floor mat on one side of the square frame

4.1.3. Place the chair on the opposite side of the mat; the chair must be kept in a fixed position

4.2. Method of assessment

4.2.1. Rise from lying flat and go sit on the chair

4.2.2. Stand up and sit on the chair twice

4.2.3. Pick up the ring and place above the head

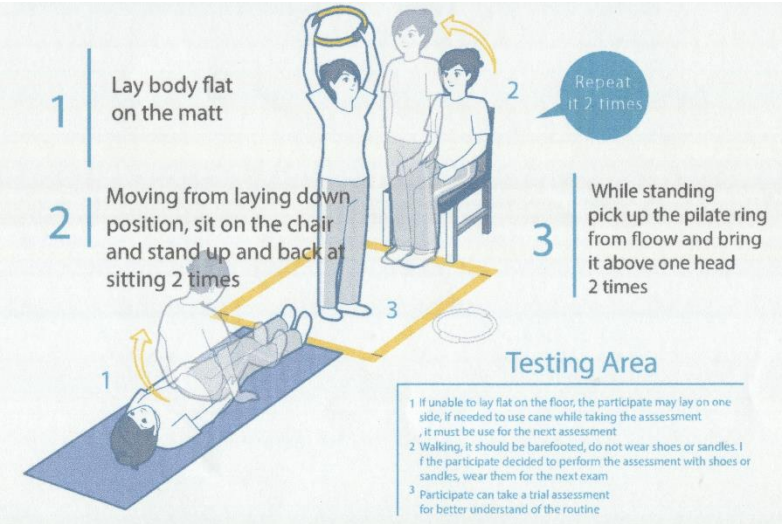


Figure 2.24: Postural change test

Source of data: Mieko Nakano and Yoshiaki Yokoyama. Self-sustained movement test. Hatachi, Japan

4.3 Method of recording results

4.3.1. Start timing when rising from the lying position until placing the ring above the head

4.3.2. Time is measured in rounded seconds

4.3.3. Do the exercise twice; rest in between the two tests; and record both required times

4.4. Assessment

The best times for each exercise are compared with a standard and the scores are displayed using animal icons to improve comprehension (Table 2.17).

Table 2.17: Presenting results of the assessment (using animal icons) from

Result	 Cheetah	 Horse	 Dog	 Rabbit	 Turtle
Total score	17+	14-16	11-13	8-10	7 or less

Source of data: Mieko Nakano and Yoshiaki Yokoyama. Self- sustained movement test. Hatachi, Japan

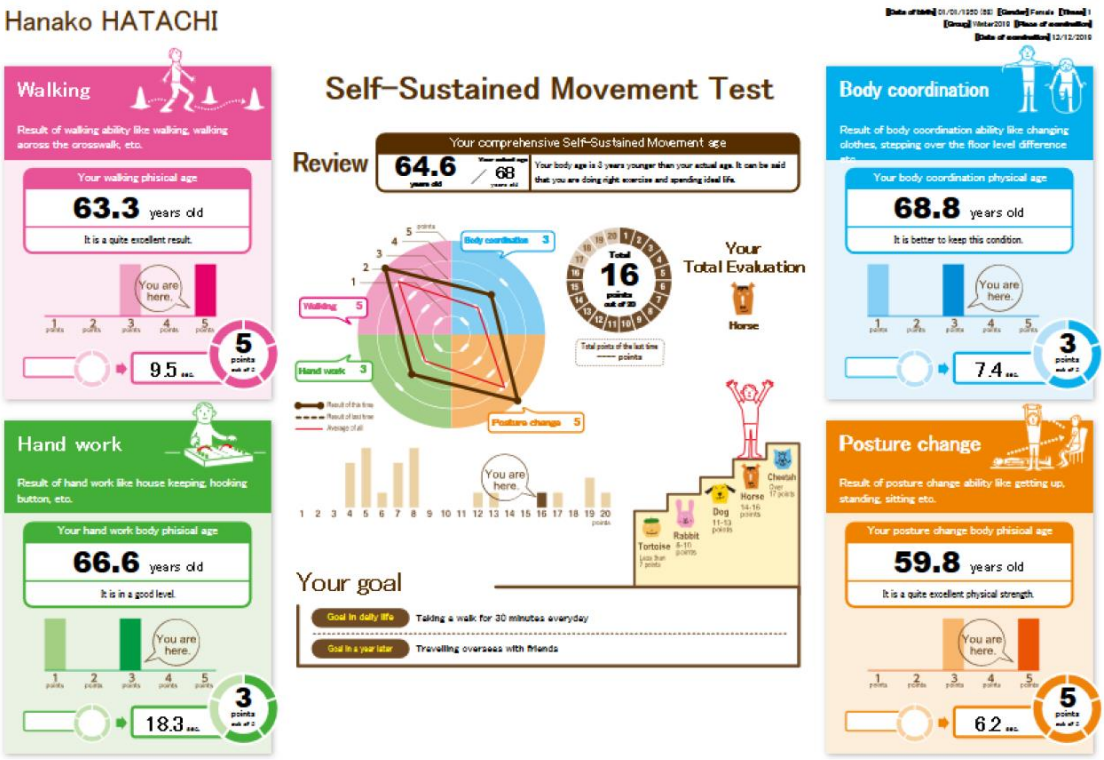


Figure 2.25: Presentation of the results of the assessment from Mieko Nakano and Yoshiaki Yokoyama. Self-sustained movement test. Hatachi, Japan

Chapter 3

Research Methodology

This study is quantitative research, and the research team was responsible for analysis of primary data collected by MOPH Health Zone #8. A sample are from population age 60 years or older, residing in three provinces of the northeast region: Udon Thani, Nongkhai, and Nong Bua Lamphu Provinces. A scheduled project duration is two years and six months (January 2018 to June 2020).

The main content of this chapter consists of: 1) Data collection methods for use as a standard for physical fitness of Thai elderly; and 2) Data collection methods for the pilot project sites, namely the experimental and the control group, to assess the results of physical fitness training.

3.1 Scope of research

This study was conducted in two phases, with the following details:

1) Phase 1: Preparation, consisting of establishment of the SSM Thailand Working Group on training coaches as SSM Masters, and data collection of Thai seniors to be used as a Thai standard;

2) Phase 2: Pilot Project Stage (2nd year) consisting of conducting an examination of the results of SSM training and presenting findings to the MOPH.

3.2 Research procedure

3.2.1 Research carried out in Phase 1

1) Preparation

1.1 Establishment of the SSM Thailand working group

The establishment of the SSM program working group was a collaboration between three agencies, including the Zone #8 Health Office, Ministry of Public Health (MOPH), Mahidol University (Institute for Population and Social Research and the College of Sports Science and Technology), and the Hatachi Co. The role of the working group is to manage the training of SSM Master Trainers, and maintenance of equipment purchased in the research such as test sets, etc.

1.2 Trainers Training Program: SSM Masters

The SSM Master is the main personnel in the replication of the SSM program in Thailand. This person oversees the SSM program activities in the pilot project site, and trains the SSM Trainer. There are eight SSM Master personnel in this research: six Masters from Udon Thani, Nongkhai and Nong Bua Lamphu Provinces, and two from the College of Sports Science and Technology.

2) Data collection of the elderly to be used as a standard

After the preparation process was complete, data were collected from a sample of elderly who participated in the SSM program, with a focus on the following: 1.Manual dexterity and hand-eye coordination; 2.Postural change/transfer; 3.Walking; and 4.Movement. The purpose of testing at this stage was to use the test results of the sample to create a Thai standard of physical ability and adjust the software to conform to the Thai context. It should be noted that Mahidol University is not responsible for the software.

Criteria for sample selection

The initial sample included males and females age 60 years or older, some of whom were in good health, while others were less healthy. The location of the sample is Mumoan and Mahkaeng Sub-districts in Udon Thani. The sample participants were selected by the staff of Zone#8 Health Center which is located in Udon Thani Province. The following are details:

2.1) Inclusion Criteria

Table 3.1 summarizes the sample participants by criteria; healthy seniors were selected based on age, gender, and health factors. Seniors age 60 years or over were screened by the Barthel ADLs Index (BI). This tool is a proficiency assessment instrument that is widely used both domestically and internationally. For this study, the Barthel Assessment Form of the Department of Health of the MOPH was used (The for was presented in Item 2.5 Evaluation Form for ADLs, Chapter 2). The BI has a full score of 20 points, and the research specified that candidates for participation in the study had to score at least 12 points.

2.2) Exclusion Criteria

As long as participants maintained their health status throughout the duration of the study, they remained included (unless being excluded for other reasons).

2.3) Discontinuation criteria

Project participants who did not follow the data collection instructions or who withdrew from the study voluntarily were excluded.

2.4) Termination Criteria for the Study

The sample of the elderly in this Thai standard study is 510 people: 280 from Mumoan and 230 from Mahkaeng, as detailed in Tables 3.1-3.3. Note: A BI score of >15 denotes very good health, while a score of 12-14 points denotes less healthy.

Table 3.1: Number of target sample in Mumoan and Mahkaeng Sub-districts of Udon Thani Province, to be used to provide standard values by the Barthel Activities of Daily Living Index (BI) and age group

		60-64	65-69	70-74	75-79	80+	Total
Male	BI≥15 points	44	44	44	44	24	200
	BI = 12-14 points	12	12	12	12	7	55
Female	BI ≥ 15 points	44	44	44	44	24	200
	BI = 12-14 points	12	12	12	12	7	55
Total	BI ≥ 15 points	88	88	88	88	48	400
	BI = 12-14 points	24	24	24	24	14	110

The number of target sample was different for Mumoan Sub-district and Mahkaeng Sub-district as the following:

Table 3.2: Number of participants from Mumoan Sub-district of Udon Thani Province (N=280) used for calculation of a standard by the Barthel Activities of Daily Living Index (BI) and age group

		60-64	65-69	70-74	75-79	80+	Total
Male	BI ≥15 points	24	24	24	24	12	108
	BI = 12-14 points	7	7	7	7	4	32
Female	BI ≥ 15 points	24	24	24	24	12	108
	BI = 12-14 points	7	7	7	7	4	32
Total	BI ≥ 15 points	48	48	48	48	24	216
	BI = 12-14 points	14	14	14	14	8	64

Table 3.3: Number of participants from Mahkaeng Sub-district of Udon Thani Province (N=230) used for calculation of a standard by the Barthel Activities of Daily Living Index (BI) and age group

		60-64	65-69	70-74	75-79	80+	Total
Male	BI ≥ 15 points	20	20	20	20	12	92
	BI = 12-14 points	5	5	5	5	3	23
Female	BI ≥ 15 points	20	20	20	20	11	91
	BI = 12-14 points	5	5	5	5	4	24
Total	BI ≥ 15 points	40	40	40	40	23	183
	BI = 12-14 points	10	10	10	10	7	47

2.5) Steps in applying the SSM test

The research team used the results of the evaluation of this sample of elderly to Thailand's standard criteria only. The SSM test was conducted in collaboration among the Health Zone# 8 office of the MOPH, JICA, Shizuoka University, Hatachi Co. and Mahidol University.

The assessment of physical fitness consists of the following four modules:

1. Walking ability

Activity: Walk around the cones along a 7-meter length; and note time required for one lap

Equipment needed: Stopwatch, cones, tape measure, masking tape

1.1. Preparation for assessment

1.1.1 Use the masking tape to make a line 7 meters long

* Allow the line to be 20 cm behind the starting line.

1.1.2 From the center line, measure 50 cm (left-right) on each side from the starting point

2 meters to the left, place cone #1

4 meters to the right, place cone #2

6 meters to the left, place cone #3

Place the cone #4 at the center line at a distance of 7 m

1.1.3 Draw an arrow pointing at the direction of cones #1, 2, 3, and circle around point 4.

1.2. Method of assessment

1.2.1. Walk from the starting point and "slalom" the cones #1, 2, 3 and 4.

1.2.2. After reaching the other end, then walk on the middle line back to the starting point.

1.3. Method of recording results

1.3.1 Time how long it takes to complete one lap

1.3.2. Units that are used in rounded seconds

1.3.3. Assess twice; rest in between the two tests; and record both required times

2. Movement ability

Activity: Use an elastic band of three sizes. Assess time to complete one repetition

Equipment needed: Stopwatch, elastic bands

2.1 Preparation for assessment

2.1.1. Prepare 3 elastic bands (120 cm, 100 cm, and 80 cm in circumference)

2.1.2. Holding the band, stretch arms as wide as possible, and measure the span between fingertips to shoulder

2.2. Method of assessment

2.2.1. Choose an appropriate band size. Grasp the band with both hands, arms stretched forward

2.2.2. Leaning forward, hold the band down to the floor and step over it, one foot at a time. Then stretch the band again, but this time behind the back, and then over the head

2.2.3. Stand upright with arms above the head and arms extended to the front.

2.2.4. Then complete the steps according to 2.2.2, and 2.2.3 (during the test the body can move forward)

2.3. Method of recording results

2.3.1. Do three repetitions

2.3.2 The unit used for measurement is rounded seconds

2.3.3. Assess twice; rest in between the two tests; and record both required times

3. Manual dexterity and hand-eye coordination

Activity: Moving pegs on a peg board with time measured to complete the process

Equipment needed: Stopwatch, peg board, pegs, table

3.1. Preparation for assessment

3.1.1 Sturdy table

3.1.2. Pegs are placed on either end of the board

3.1.3. Move pegs from the ends to the middle, alternate using the right hand for one side, and the left for the other

3.2 Method of assessment

3.2.1. Move the pegs to the middle row, starting with the nearest peg

3.2.2. Move pegs from the ends to the middle, alternate using the right hand for one side, and the left for the other

3.3 Method of recording results

3.3.1 One cycle is complete when all pegs are moved to the middle row and then back to their original place

3.3.2 Measure time to complete the cycle in rounded seconds

3.3.3. Perform the cycle twice; rest in between the two tests; and record both required times

4. Postural change ability (transfer)

Activity: Moving from a lying to a standing and then sitting position (twice); bending over to pick up a ring and raise that above the head; timing each cycle

Equipment needed: Stopwatch, tape measure, masking tape, floor mat, ring, and chair

4.1 Preparation for assessment

4.1.1. Use masking tape to make a 1 sq m frame

4.1.2. Lay the floor mat on one side of the square frame

4.1.3. Place the chair on the opposite side. The floor mat and chair must be in a fixed position

4.2. Method of assessment

4.2.1 Lie down on a mat then stand up and walk to the chair

4.2.2 Sit on a chair – stand and sit 2 times

4.2.3 When sitting up from the chair for a second time, pick up the ring from the floor and lift it above the head.

4.3. Method of recording results

4.3.1 Measure the time to complete one cycle

4.3.2 The unit of time is rounded minutes

4.3.3 Perform two cycles; rest in between the two tests; and record both required times

Summary of details of the four assessments

	Basic ability	Practical applications	Measurement
1	Walking	Walking, climbing up and down stairs, crossing an intersection with a timed signal, walking safely through an obstacle course	Smooth walking ability
2	Movement	Changing clothes, bathing, using the bathroom	Self-reliance
3	Manual dexterity, hand-eye coordination	Housework, gardening, buttoning a shirt/pants	Using hands for tasks
4	Changing posture	Standing up from a lying or sitting position	Transfer of body position

Preparation of site and equipment/supplies

Preparation of location

	Steps	Area dimensions (meters)
1	Walking space	9m X 4m
2	Changing posture	5m X 3m
3	Movement	5m X 3m
4	Manual dexterity, hand-eye coordination	5m X 3m with good lighting

* If the area is not big enough, divide the exercise into portions

* Provide seating for those waiting to be tested

Preparation of equipment/supplies

- Assessment form
- If there are to be many people tested, then prepare supplies accordingly

Necessary equipment/supplies	
Peg board	Ring
Floor mat	Stretch bands
Cones	Masking tape
Tape measure (at least 10 meters)	Chair with back rest
4 stop matches	Table
Writing implements	Form to record results

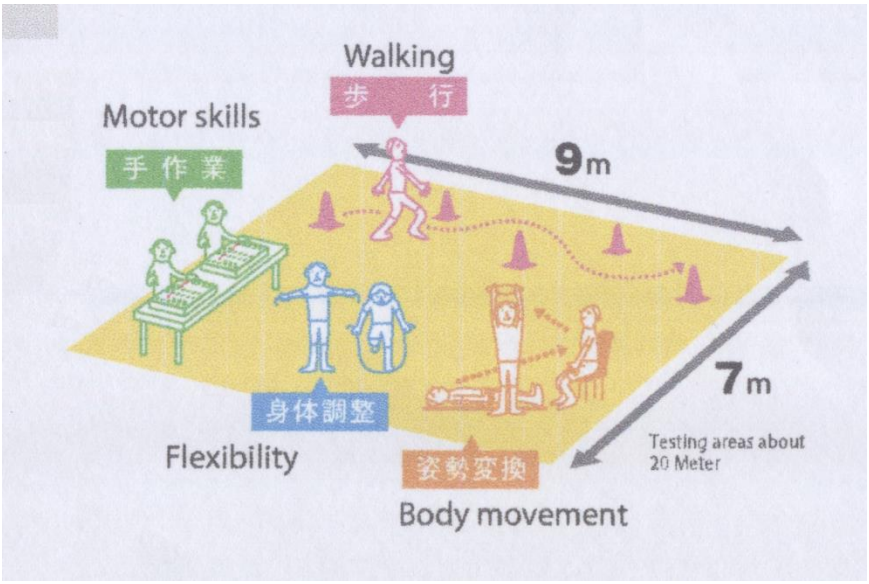


Figure 3.1: SSM Test: 4 assessments

Source of data: Mieko Nakano and Yoshiaki Yokoyama. Self-sustained movement test. Hatachi, Japan

2.6) Setting standards for Thai project participants

After collecting information from the elderly by assessing their physical fitness, the research team determined the evaluation criteria of the Thai elderly for the pilot project. The data analysis was conducted by Mahidol University in collaboration with Shizuoka University and Hatashi Co.

The assessment criteria for the Thai elderly are classified by gender (male-female), age group (60-64 years, 65-69 years, 70-74 years, 75-79 years, and 80 years or older), and according to the basic capabilities in all four activity groups, including the ability to walk, ability to move, manual dexterity, and ability to change posture.

Calculating scores to use as a baseline for Thai elderly

Step 1: Data Management

After receiving the raw data from JICA, the research team cleaned the data to check for internal consistency, etc. The SSM test was conducted twice for each activity, the best time was used. Plus, the distribution of the data for each test in each age group and gender must have had a normal distribution to be accepted. The data were subject to descriptive statistics analysis, including measures of central tendency (mean, mode, median) and measures of dispersion (variance, range, standard deviation, and skewness). Data were screened for outliers, i.e., more than +/- 2SD.

Step 2 Calculate the mean and SD values of the elderly

In determining the standard values for Thai elderly, the researchers calculated means and SD values by dividing the sample into five age groups: 60-64 years, 65-59 years, 70-74 years, 75-79 years and 80 years or older more, classified by gender, and by performance on the four activity tests.

Step 3 Determine the standard criteria for each activity

After computing the standard time for Thai elderly, that value was used to analyze the relative speed of the elderly in each age group and gender across the four activity tests.

Step 4 Analyzing the sum of the scores obtained from physical fitness training

The performance scores were compared based on age and speed, as represented by different animal icons. There are scores by activity and for all activities together.

Assigning scores and evaluation criteria

The results of the performance from this sample of elderly assessments provided the basis for establishing criteria across the four groups of activities. Scores range from 1-5 points per activity, or a total potential score of 20 points, classified as follows:

1 point - slow
2 points - somewhat slow
3 points - normal
4 points - somewhat fast
5 points - fast

The physical fitness of each elderly person was evaluated by the total score (i.e., against the possible 20 points). The following table summarizes the results:

Results	 Cheetah	 Horse	 Dog	 Rabbit	 Turtle
Total points	17+	14-16	11-13	8-10	7 or less

3.2.2 Phase-2: Pilot Project (second year activity)

1) Selection of pilot project areas and project participants

As noted, three provinces were purposively selected for the pilot project: Udon Thani, Nongkhai, and Nong Bua Lamphu. A total of 800 participants were included in the pilot study (400 males and 400 females who are healthy seniors and did not use walking aids), while taking into account age, gender and other health factors.

Table 3.4: Elderly participants by province

Province (target number of participants)	In good health (male)	In good health (female)	Total
Udon Thani (400))	200	200	400
Nongkhai (200)	100	100	200
Nong Bua Lamphu (200)	100	100	200
Total	**400**	**400**	**800**

A target of 490 elderly were selected using the randomized controlled trial (RCT) method, in the following four sub-districts of the three provinces:

1. Udon Thani, Sam Phrao
2. Udon Thani, Nern Sung
3. Nongkhai, Ban Trat
4. Nong Bua Lamphu, Ban Khram

The participants were divided into experimental and control groups. The experimental group received training in the SSM Program for three months, with pre- and post-assessments of performance.

The number of sample participants at each step is presented in Chapter 4, Item 4.2.1

Assessment of healthy elderly

Assessment of the health status of the elderly was completed in Phase 1. Those who were assessed as in "good health" only (i.e., BI = 12 or above) were included in the pilot study.

2) Conducting SSM assessment and physical fitness training

2.1 Conducting the SSM assessment

Each participant during the pilot phase received two SSM assessments. In addition, there was a survey on health care concerns and measuring body statistics (height, weight, body mass index, muscle mass, strength of the arm muscles, percentage of body fat, blood pressure, heart rate, waist circumference, etc.).

The physical ability of the SSM assessment is divided into four types of measures:

1) Walking ability

2) Ability to move

3) Manual dexterity

4) Ability to change postures

The participants received from 1 to 5 points for each type of assessment. The assessment scores were totaled to produce an overall value. After that, the sample was divided into experimental and control groups. All participants signed consent to participate in the project before training began.

2.2 Training in physical ability

2.2.1 Experimental group

The SSM physical fitness training regimen works on basic movements, postures, muscle use, manual dexterity, standing up, and walking, among other movements. In the experimental group, participants did the training for 30-60 minutes per session, for a total of 6 times, continuously every two weeks for 3 months (January - March 2019).

Participants received a training log, and performance was divided into two parts, including 7 basic exercise postures and 7 muscle training postures. Participants were then

instructed to implement the SSM regimen at home, 30 -60 minutes per time, and 2-3 times a week. Every 2 weeks, the experimental group met with the SSM Master to increase the amount and intensity of the exercise regimen.

After three months of training (April 2019), there was an assessment of SSM performance to analyze change in the four groups of physical ability (walking, movement, manual dexterity, posture transfer). After that, the experimental group did not receive any additional training or coaching for three months, but received another SSM assessment in September 2019.

2.2.2 Control group

For the elderly in the control group, there was no SSM training during the first three months (January - March 2019). However, there was an assessment of ability across the four physical activity groups in April 2019, just as with the experimental group. After that, during May - July 2019, the elderly in this control group received the same training in the SSM program as the experimental group, and was assigned the same regimen of six 30-60-minute sessions, every two weeks for 3 months as well. The control group was given the SSM assessment again in September 2019.

In all this, the SSM Master Trainer described the program for the participants, coached them in doing the activities, and used the equipment and materials provided by the Hatachi Co.

2.2.3 During April - June 2019, the members of the experimental group switched to the control group (Group1: from training to control) and the control group switched to the experimental group (Group 2: from control to training), i.e., a crossover design.

2.2.4 Data sets 1 and 2 for the experimental group were compared.

2.2.5 There are three data points for the experimental group: Time 0, i.e., just before training; at 3 months after being trained, and at 6 months. (stop training)

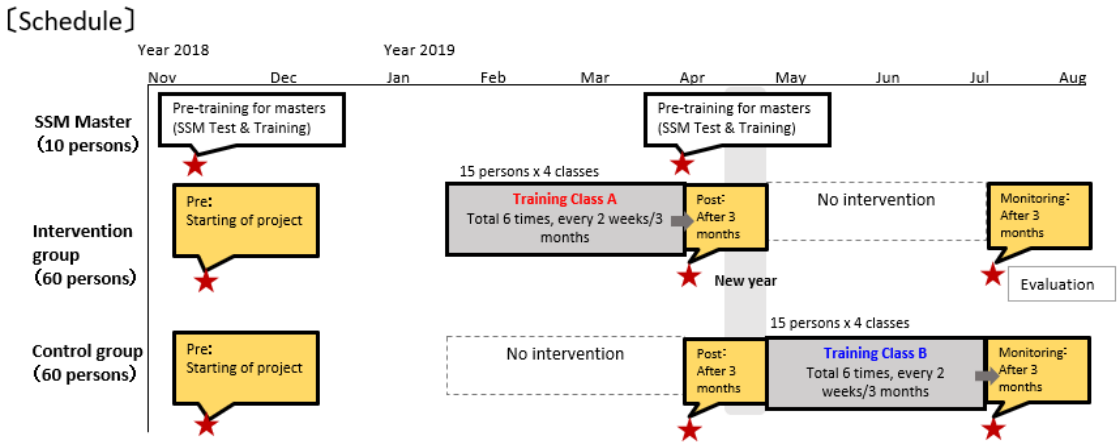


Figure 3.2: Steps in assessment and training of elderly in the experimental and control groups

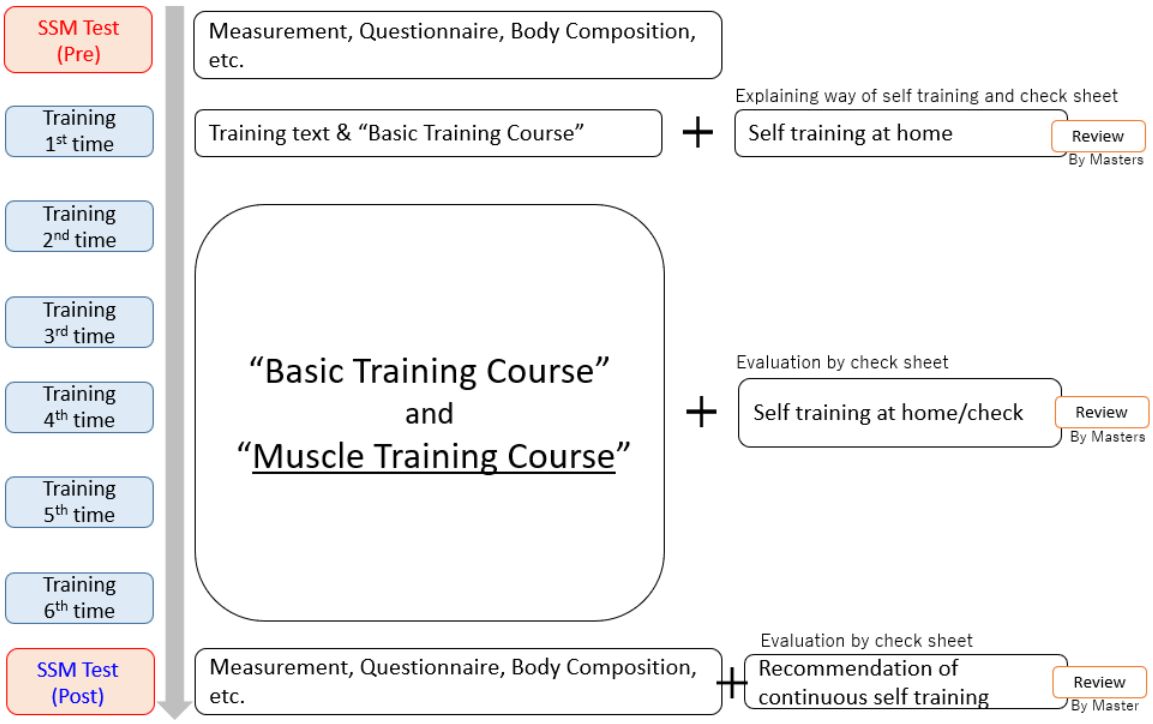


Figure 3.3: Steps in training the elderly in the experimental and control groups

Chapter 4

Results

This chapter presents the results in two sections. The first section is the assessment of mean scores of physical abilities of Thai seniors (A Thai standard physical ability). The second section is the results of the exercise training program according to the study design described in Chapter 3.

4.1 Assessment criteria for standard values of the Thai elderly

In the first phase of Year 1, data were collected from 560 elderly people in the project at Mumoan and Makhaeng Sub-districts of Udon Thani Province, consisting of 263 men and 297, as shown in Tables 4.1 and 4.2. The target number of participants and actual number recruited are shown in Table 4.5. Participants were selected in collaboration with staff of the Health Zone #8 Office of the MOPH, which is located in Udon Thani Province. This preliminary data were used to adjust the software so that analysis would be more suited to the Thai population characteristics. (The Japanese team is the operator of the software.)

Participants were assessed using the Barthel Index (BI) test, which has 10 questions (full score = 20 points). The questionnaire was presented in Section 2.5, Chapter 2. The sub-set of the sample who scored 12 points or more for the BI were included in the first phase of the study. Those persons are classified as follows:

1.1 Elderly whose BI score was 15-20 points

1.2 Elderly whose BI score was 12-14 points

Table 4.1: Targeted sample group from Mumoan and Mahkaeng Sub-districts of Udon Thani Province (N = 510)

Sex	Classified by BI score	60-64	65-69	70-74	75-79	80+	Total
Male	BI ≥ 15	44	44	44	44	24	200
	BI = 12-14	12	12	12	12	7	55
Female	BI ≥ 15	44	44	44	44	24	200
	BI = 12-14	12	12	12	12	7	55
Total	BI ≥ 15	88	88	88	88	48	400
	BI = 12-14	24	24	24	24	14	110

Table 4.2: Actual sample of elderly in the two sub-districts of Udon Thani province (N = 560)

Sex	Classified by BI score	60-64	65-69	70-74	75-79	80+	Total
Male	BI ≥ 15	52	52	58	41	18	221
	BI = 12-14	7	8	6	13	10	44
Female	BI ≥ 15	54	67	58	35	18	232
	BI = 12-14	12	11	14	13	13	63
Total	BI ≥ 15	106	119	116	76	36	453
	BI = 12-14	19	19	20	26	23	107
	Total						**560**

Table 4.3: Targeted and actual sample of elderly

Sex	Targeted vs. actual Sample	60-64	65-69	70-74	75-79	80+	Total
Male	Targeted	56	56	56	56	31	255
	Actual sample	59	59	64	53	28	263
Female	Targeted	56	56	56	56	31	255
	Actual sample	66	79	72	49	31	297
Total	Targeted	112	112	112	112	62	510
	Actual sample	125	138	135	102	59	560

Table 4.4: Net difference between the number of targeted and actual sample

	60-64	65-69	70-74	75-79	80+	Total
Male	+3	+3	+8	-3	-3	+8
Female	+10	+23	+16	-7	0	+42

Table 4.5: Number of targeted participants and net (actual) sample by sub-district

1. Mahkaeng Sub-district

1.1 Target sample (230)

Sex	Classified by BI score	60-64	65-69	70-74	75-79	80+	Total
Male	BI ≥ 15	20	20	20	20	12	92
	BI = 12-14	5	5	5	5	3	23
Female	BI ≥ 15	20	20	20	20	11	91
	BI = 12-14	5	5	5	5	4	24
Total	BI ≥ 15	40	40	40	40	23	183
	BI = 12-14	10	10	10	10	7	47

1.2 Net Sample (256)

Sex	Classified by BI score	60-64	65-69	70-74	75-79	80+	Total
Male	BI ≥ 15	13	22	29	21	10	95
	BI = 12-14	3	4	2	8	2	19
Female	BI ≥ 15	27	35	30	18	8	118
	BI = 12-14	5	4	8	3	4	24
Total	BI ≥ 15	40	57	59	39	18	213
	BI = 12-14	8	8	10	11	6	43
						Total	**256**

2. Mumoan Sub-district

2.1 Target sample (280)

Sex	Classified by BI score	60-64	65-69	70-74	75-79	80+	Total
Male	BI ≥ 15	24	24	24	24	12	108
	BI = 12-14	7	7	7	7	4	32
Female	BI ≥ 15	24	24	24	24	12	108
	BI = 12-14	7	7	7	7	4	32
Total	BI ≥ 15	48	48	48	48	24	216
	BI = 12-14	14	14	14	14	8	64

2.2 Net Sample (304)

Classified by BI score		60-64	65-69	70-74	75-79	80+	Total
Male	BI ≥ 15	39	30	29	20	8	126
	BI = 12-14	4	4	4	5	8	25
Female	BI ≥ 15	27	32	28	17	10	114
	BI = 12-14	7	7	6	10	9	39
Total	BI ≥ 15	66	62	57	37	18	240
	BI = 12-14	11	11	10	15	17	64
						Total	**304**

Data to establish standard values for Thais were collected twice during April 2018, and repeated again for some participants in November the same year. Details are in the below section.

4.1.1 Analysis to establish standard values for Thais

There are two versions of the analysis of the standard values based on data collection during April 23-27, 2018. Initial analysis revealed considerable variation in the distribution of the data (Tables 4.7.-4.8) which required a repeat of the data collection for 200 persons in Makhaeng Sub-district. That repeat field work was conducted during Nov. 6-7, 2018, and the results were combined with the first round of data collection. That combined data set represents Version 2 of the analysis. Details are below:

Version 1. After collecting the first set of data, the research team conducted routine cleaning of the data and elimination of outliers (i.e., those with values in excess of 2 SD). Preliminary analysis of the data to produce standard test scores (i.e., Criteria Version 1) found anomalies of the data by sex and age. The following lists pattern of scores on the ability to perform the four physical ability tests based on this data set:

1) The average of the duration that the elderly required to perform each of these four activities increased with increasing age;

2) The standard deviation of the average of the duration that elderly people require to perform the activities increased with increasing age;

3) Most of the elderly males were able to perform better than the elderly females;

4) The testing of bodily movement ability took the least time, followed by the ability to change posture (i.e., transfer), walking, and manual dexterity, in descending order.

However, the scores for the elderly in the initial testing did not conform to these expected tendencies by sex and age, as depicted below:

1) Elderly females out-performed males in bodily movement in the age groups 75-79, and 80 years or older, and for posture changing (transfer) for those age 60-64, 65-69, and 80 years or older;
2) The mean duration of time required to do some activities did not increase with age;
3) The sample size of elderly doing the walking test was very small, and that produced unreliable variation in the mean scores and SD;
4) Abnormal score of body adjustment test in male who got 4 and 5 points were found in elderly Male Age 75-79 years and 80 years or older
5) In the test for body adjustment, the scores of 4 and 5 points for females age 80 years or older found abnormal.
6) Tests of speed in the test of manual dexterity produced scores of 4 or 5 points in males age 75-79 years, and males and females age 80 years or older found abnormal.
7) Tests of speed of movement produced scores of 4 or 5 points in males age 70-79 years, and females age 75 years or older found abnormal.
8) Some of these variations or unexpected findings might be due to the small sample sizes, especially for the oldest age group.

Table 4.6: Mean and SD of the elderly test scores

Males

		60～	65～	70～	75～	80～
Walking	Quantity of data	69	58	58	35	13
	Mean	10.86	11.71	12.09	13.28	15.44
	Standard deviation	1.77	1.83	2.03	2.67	3.40
Bodily movement	Quantity of data	101	87	87	62	29
	Mean	6.85	7.19	7.76	8.14	9.70
	Standard deviation	0.99	1.08	1.35	1.60	2.22
Manual dexterity	Quantity of data	99	85	84	61	23
	Mean	20.94	21.98	23.20	24.42	26.53
	Standard deviation	1.92	2.49	2.26	2.26	2.73
Posture changing	Quantity of data	102	83	83	62	29
	Mean	8.36	9.22	9.63	10.73	13.49
	Standard deviation	1.07	1.25	1.62	2.19	3.11

Females

		60～	65～	70～	75～	80～
Walking	Quantity of data	67	70	56	53	45
	Mean	11.60	12.57	13.66	15.55	17.34
	Standard deviation	1.59	1.96	2.01	2.99	4.08
Bodily movement	Quantity of data	90	103	83	79	49
	Mean	7.32	7.83	8.17	9.25	9.30
	Standard deviation	1.22	1.39	1.40	2.34	2.08
Manual dexterity	Quantity of data	88	99	78	79	46
	Mean	20.75	22.06	23.15	25.21	27.06
	Standard deviation	1.74	1.81	2.05	2.65	3.13
Posture changing	Quantity of data	78	103	86	71	49
	Mean	8.94	10.31	11.05	11.92	13.49
	Standard deviation	1.25	1.98	1.94	2.32	3.49

Table 4.7: Tests of physical ability of the elderly (Version 1) analyzed in November, 2018

Male: Thailand

Walking:

Age group	5 points	4 points	3 points	2 points	1 point
60-64	<8.2	8.3-10.0	10.1-11.7	11.8-13.5	13.6>
65-69	<9.0	9.1-10.8	10.9-12.6	12.7-14.4	14.5>
70-74	<9.1	9.2-11.1	11.2-13.1	13.2-15.1	15.2>
75-79	<9.4	9.5-12.0	12.1-14.6	14.7-17.3	17.4>
80+	<10.3	10.4-14.1	10.2-17.8	17.9-21.6	21.7>

Bodily movement:

Age group	5 points	4 points	3 points	2 points	1 point
60-64	<5.2	5.3-6.4	6.5-7.6	7.7-8.9	9.0>
65-69	<5.5	5.6-6.6	6.7-7.8	7.9-9.0	9.1>
70-74	<5.5	5.6-7.2	7.3-8.8	8.9-10.4	15.2>
75-79	<5.2	5.3-7.5	7.6-9.9	10.0-12.2	12.3>
80+	<5.5	5.6-8.7	8.8-11.9	12.0-15.1	15.2>

Manual dexterity:

Age group	5 points	4 points	3 points	2 points	1 point
60-64	<17.6	17.7-19.9	20.0-22.2	22.3-24.6	>24.7
65-69	<18.1	18.2-20.8	20.9-23.6	23.7-26.3	>26.4
70-74	<19.2	19.3-22.3	22.4-25.3	25.4-28.4	>28.5
75-79	<18.9	19.0-23.2	19.0-23.2	27.6-31.8	>31.9
80+	<17.8	17.9-25.1	25.2-32.3	32.4-39.6	>39.7

Posture changing:

Age group	5 points	4 points	3 points	2 points	1 point
60-65	<6.6	6.6-7.9	8.0-9.1	9.2-10.4	>10.5
65-69	<7.1	7.1-8.7	8.8-10.3	10.4-11.9	>12.0
70-74	<6.5	6.5-9.0	9.1-11.5	11.6-14.1	>14.2
75-79	<6.5	6.9-9.9	10.0-13.0	13.1-16.0	>16.1
80+	<8.5	8.5-12.2	12.3-15.9	16.0-19.5	>19.6

Female: Thailand

Walking:

Age group	5 points	4 points	3 points	2 points	1 point
60-64	<9.1	9.2-10.9	11.0-12.7	12.8-14.5	>14.6
65-69	<9.6	9.7-11.6	11.7-13.5	13.6-15.5	>15.6
70-74	<10.6	10.7-12.7	12.8-14.7	14.8-16.7	>16.8
75-79	<11.1	11.2-14.1	14.2-17.0	17.1-20.0	>20.1
80+	<11.2	11.3-15.3	15.4-19.4	19.5-23.5	>23.6

Bodily movement:

Age group	5 points	4 points	3 points	2 points	1 point
60-64	<5.1	5.2-6.8	6.9-8.6	8.7-10.3	>10.4
65-69	<5.4	5.5-7.3	7.4-9.1	9.2=11.0	>11.1
70-74	<5.7	5.8-7.6	7.7-9.5	9.6-11.4	>11.5
75-79	<5.0	5.1-8.3	8.4-11.7	11.8-15.1	>15.2
80+	<4.1	4.2-8.5	8.6-12.9	13.0-17.2	>17.3

Manual dexterity:

Age group	5 points	4 points	3 points	2 points	1 point
60-64	<17.8	17.9-20.0	20.1-22.2	22.3-24.5	>24.6
65-69	<19.0	19.1-21.4	21.5-23.9	24.0-26.3	>26.4
70-74	<19.6	19.7-22.2	22.3-24.8	24.9-27.4	>27.5
75-79	<20.9	21.0-23.9	24.0-26.8	26.9-29-7	>29.8
80+	<20.5	20.6-25.6	25.7-30.8	30.9-35.9	>36.0

Posture changing:

Age group	5 points	4 points	3 points	2 points	1 point
60-64	<6.5	6.6-8.8	8.9-11.1	11.2-13.4	>13.5
65-69	<7.0	7.1-9.7	9.8-12.3	12.4.14.9	>15.0
70-74	<7.8	7.9-10.3	10.4-12.8	12.9-15.4	>15.5
75-79	<7.6	7.7-11.9	12.0-16.1	16.2-20.3	>20.4
80+	<6.2	6.3-12.6	12.7-18.9	19.0-25.2	>25.3

Version 2: Based on the abnormal findings in the first application of the test and the combined two data sets in April and November 2018, the research team in collaboration with their Japanese counterparts who recommended removing outlier values from the new dataset (i.e., >2SD).

4.1.2 Mean of the standard score of duration required to conduct the four tests of physical ability (Thai sample)

After smoothing of the data, values for the tests were produced (Version 2) for analysis, as follows:

Table 4.8: Final evaluation criteria for Thai elderly (Version 2) Final Evaluation Criteria of Thailand (units: seconds)

Male

Walking (second)

Age group	5 points	4 points	3 points	2 points	1 point
60~64 ปี	~8.2	8.3~10.0	10.1~11.7	11.8~13.5	13.6~
65~69 ปี	~9.0	9.1~10.8	10.9~12.6	12.7~14.4	14.5~
70~74 ปี	~9.1	9.2~11.1	11.2~13.1	13.2~15.1	15.2~
75~79 ปี	~9.4	9.5~12.0	12.1~14.6	14.7~17.3	17.4~
80~ ปี	~10.3	10.4~14.1	14.2~17.8	17.9~21.6	21.7~

Bodily movement (second)

Age group	5 points	4 points	3 points	2 points	1 point
60~64 ปี	~5.2	5.3~6.3	6.4~7.4	7.5~8.5	8.6~
65~69 ปี	~5.5	5.6~6.6	6.7~7.7	7.8~8.8	8.9~
70~74 ปี	~5.5	5.6~7.0	7.1~8.5	8.6~10.0	10.1~
75~79 ปี	~6.1	6.2~7.8	7.9~8.9	9.0~10.6	10.7~
80~ ปี	~6.2	6.3~8.5	8.6~10.8	10.9~13.1	13.2~

Manual dexterity (second)

Age group	5 points	4 points	3 points	2 points	1 point
60~64 ปี	~17.7	17.8~19.8	19.9~21.9	22.0~24.0	24.1~
65~69 ปี	~18.2	18.3~20.7	20.8~23.2	23.3~25.7	25.8~
70~74 ปี	~19.7	19.8~22.0	22.1~24.3	24.4~26.6	26.7~
75~79 ปี	~20.9	21.0~23.2	23.3~25.5	25.6~27.8	27.9~
80~ ปี	~22.1	22.2~25.0	25.1~27.9	28.0~30.8	30.9~

Posture changing (second)

Age group	5 points	4 points	3 points	2 points	1 point
60~64 ปี	~6.7	6.8~7.8	7.9~8.9	9.0~10.0	10.1~
65~69 ปี	~6.9	7.0~8.5	8.6~9.8	9.9~11.1	11.2~
70~74 ปี	~7.0	7.1~8.7	8.8~10.4	10.5~12.1	12.2~
75~79 ปี	~7.2	7.3~9.5	9.6~11.8	11.9~14.1	14.2~
80~ ปี	~8.5	8.6~11.8	11.9~15.1	15.2~18.4	18.5~

※ ข้อมูลผลประเมิน

Female

Walking (second)

Age group	5 points	4 points	3 points	2 points	1 point
60~64	~9.1	9.2~10.9	11.0~12.7	12.8~14.5	14.6~
65~69	~9.6	9.7~11.6	11.7~13.5	13.6~15.5	15.6~
70~74	~10.6	10.7~12.7	12.8~14.7	14.8~16.7	16.8~
75~79	~11.1	11.2~14.1	14.2~17.0	17.1~20.0	20.1~
80~	~11.2	11.3~15.3	15.4~19.4	19.5~23.5	23.6~

Bodily movement (second)

Age group	5 points	4 points	3 points	2 points	1 point
60~64	~5.3	5.4~6.6	6.7~7.9	8.0~9.2	9.3~
65~69	~5.5	5.6~7.0	7.1~8.5	8.6~10.0	10.1~
70~74	~5.9	6.0~7.4	7.5~8.9	9.0~10.4	10.5~
75~79	~6.0	6.1~8.0	8.1~10.5	10.6~11.4	11.5~
80~	~6.1	6.2~8.2	8.3~10.3	10.4~12.4	12.5~

Manual dexterity (second)

Age group	5 points	4 points	3 points	2 points	1 point
60~64	~17.9	18.0~19.8	19.9~21.7	21.8~23.6	23.7~
65~69	~19.2	19.3~21.1	21.2~23.0	23.1~24.9	25.0~
70~74	~20.0	20.1~22.1	22.2~24.2	24.3~26.3	26.4~
75~79	~21.1	21.2~23.8	23.9~26.5	26.6~29.2	29.3~
80~	~22.1	22.2~25.4	25.5~28.7	28.8~32.0	32.1~

Posture changing (second)

Age group	5 points	4 points	3 points	2 points	1 point
60~64	~6.9	7.0~8.2	8.3~9.5	9.6~10.8	10.9~
65~69	~7.1	7.2~9.2	9.3~11.3	11.4~13.4	13.5~
70~74	~7.9	8.0~10.0	10.1~12.1	12.2~14.2	14.3~
75~79	~8.1	8.2~10.6	10.7~13.1	13.2~15.6	15.7~
80~	~8.2	8.3~11.7	11.8~15.2	15.3~18.7	18.8~

4.1.3 Interpreting means for duration of time required to conduct the four tests of physical ability

Table 4.9 shows the evaluation of the physical fitness tests of the elderly classified by sex and age group which are 60-64, 65-69, 70-74, 75-79, and 80 years or older, and according to four types of physical ability, which are walking, bodily movement, manual dexterity, and posture. Speed levels are divided into fast (5 points), quite fast (4 points), normal (3 points), quite slow (2 points), slow (1 point).

Males

When analyzing the walking ability of males, it was found that the performance for those age 60 - 64 years had a slow level of 13.6 seconds, a quite slow level of 11.8 - 13.5 seconds, a normal level of 10.1 - 11.7 seconds, a quite fast level is 8.3 - 10.0 seconds, and a fast level of 8.2 seconds. Males age 65 - 69 years performed at a slow level of 14.5 seconds, a quite slow level of 12.7 - 14.4 seconds, a normal level of 10.9 - 12.6 seconds, a quite fast level of 9.1 - 10.8 seconds, and a fast level of 9.0 seconds. Males age 70 - 74 years performed at a slow level of 15.2 seconds, quite slow at 13.2 - 15.1 seconds, normal at 11.2 - 13.1 seconds, quite fast at 9.2 - 11.1 seconds, and fast at 9.1 seconds. Males age 75 - 79 years performed at a slow level of 17.4 seconds, a quite slow level of 14.7. - 17.3 seconds, a normal level of 12.1 - 14.6 seconds, a quite fast level of 9.5 - 12.0 seconds, and a fast level of 9.4 seconds. Males age 80 years or older performed at a slow level of 21.7 seconds, a quite slow level of 17.9 - 21.6 seconds, a normal level of 14.2 - 17.8 seconds, a quite fast level of 10.4. - 14.1 seconds, and a fast level equal to 10.3 seconds.

Interpretation of general movement ability, manual dexterity, and posture modification of the males is similar as the ability to walk, as described above (Table 4.8)

Females

When analyzing the walking ability of the female elderly, it was found that the ability of females age 60 - 64 years was slow at 14.6 seconds, quite slow at 12.8 - 14.5 seconds, normal at 11.0 - 12.7 seconds, quite fast at 9.2 - 10.9 seconds, and fast at 9.1 seconds. Females age 65-69 years performed at a slow of 15.6 seconds, a quite slow level of 13.6 - 15.5 seconds, a normal level of 11.7 - 13.5 seconds, a quite fast level of 9.7 - 11.6 seconds and a fast level of 9.6 seconds. Females age 70 - 74 years performed at a slow level of 16.8 seconds, a quite slow level of 14.8 - 16.7 seconds, a normal level of 12.8 - 14.7 seconds, a quite fast level of 10.7 - 12.7 seconds, and a fast level of 10.6 seconds. Females age 75 - 79 years performed at a slow level of 20.1 seconds, a quite slow level of 17.1 - 20.0 seconds, a normal level of 14.2 - 17.0 seconds, a quite fast level of 11.2 - 14.1 seconds, and a fast level of 11.1 seconds. Females age 80 years or older performed at a slow level of 23.6 seconds, a quite slow level of 19.5 - 23.5 seconds, at a normal level of 15.4 - 19.4 seconds, a quite fast level at 11.3 - 15.3 seconds, and a fast level at 11.2 seconds.

Interpretation of general movement ability, manual dexterity, and posture modification of the females is similar as the ability to walk, as described above.(Table 4.8)

4.1.4 Summary

Based on the analysis of the mean scores of the physical ability of this sample of elderly, the following can be summarized:

1) Both males and females had durations required to perform the four activities which increased with age;
2) Both males and females had the shortest durations of time for the general movement exercise test, followed by changing posture, walking, and manual dexterity;
3) Elderly males outperformed their female counterparts (i.e., had faster times).

4.2 Training in physical ability of the elderly

4.2.1 The conational statistical officer diagram of the sample and total number of participants in the pilot project (Figure 4.1).

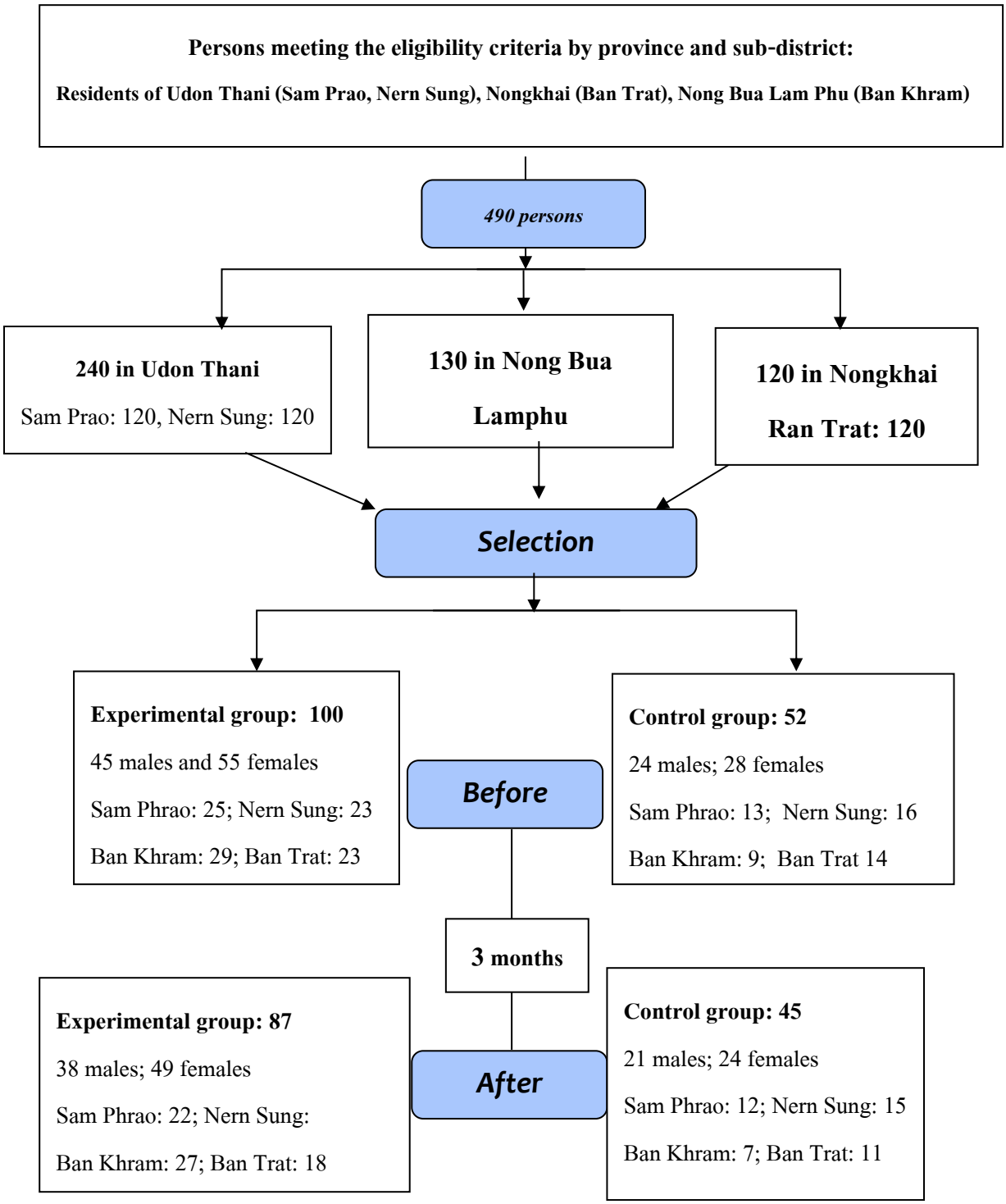


Figure 4.1: Steps in selection of the sample and total number of participants in the pilot project

4.3 Effects of a 3-month SSM program training

The presentation of results is divided into the following four sections:

4.3.1 Dataset #1: Results of the comparison of physical fitness training between the Experimental group (Group 1: Training), which is the elderly group who received the performance training for 3 months, and the Control group (Group 2: Control) which is the elderly group that has not received fitness training, and performed normal daily activities. (Data were collected during January – March, 2019)

4.3.2 Dataset # 2: Results of the physical fitness training obtained from changing the Experimental group to a Control group (Group 1: Training to control; Control) and changing the Control group to Experimental group (Group 2: Control to train; Experimental). (Data were collected during April – June, 2019)

4.3.3 Dataset # 3: Results of comparison of the Experimental group from Dataset # 1 (Group 1: Training) and the Experimental group from Dataset # 2 (Group 2: Training).

4.3.4 Dataset # 4: Results of the comparison of the results of the three times intervals for Group 1: Training: before the training (Month 0), 3 months after training (Month 3), and 3 months after stopping the training (Month 6), i.e., in October, 2019.

Results of each dataset

4.3.1. Dataset #1

4.3.1.1. Mean of the general physical characteristics (Group 1: Training and Group 2: Control) before beginning the training program

Group 1: Training, consisted of 100 participants, 45 males and 55 females. The average age was 69 years. Group 2: Control, consisted of 52 participants, 24 males and 28 females. The average age was 71 years. The general characteristics before physical fitness training found that there was no difference in the mean level of general characteristics between the training group and the Control group (Table 4.9).

Table 4.9: Mean level of general characteristics of sample members in Group 1 (Training) and Group 2 (Control) prior to the training program

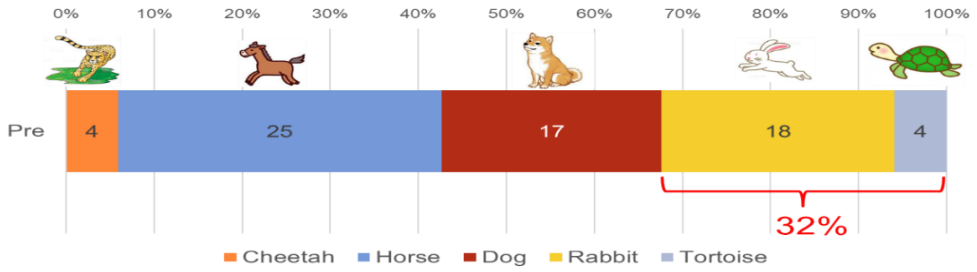
	Group 1: Training (N=100)	Group 2: Control (N=52)
Sex (male/female)	45/55	24/28
Age (years)	69±7	71±8
Weight (kg)	57.9±11.3	58.2±9.5
Body mass index (kg / m ^{2})	23.5±3.5	23.7±4.0
Resting heart rate (bpm)	80±12	80±12
Systolic BP (mmHg)	138±19	135±18
Diastolic BP (mmHg)	74±10	73±10
Muscle mass (%)	39.4±8.0	39.2±6.5
Percentage of body fat (%)	27.6±8.5	27.9±10.7
Grip strength (kg)	21.0±7.5	20.9±7.5

4.3.1.2 Comparison of physical ability when classified by type of the animal icon between Group 1 (Training) and Group 2 (control) by number of participants with mean Barthel ADLS Index (BI) = 20

It was found that 68 members of Group 1 had BI = 20 out of a total of 87 persons. When classified by type of the animal (representing speed), it was found that Rabbit = 18 persons, and Tortoise = 4 persons (or a proportion of about one in three). In Group 2, 35 members had BI = 20 out of a total of 45 persons. According to the animal icons, Rabbit = 6 persons, and Tortoise = 1 person (or a proportion of about one in five). This indicates that the baseline measures of physical ability of the Control group was distinctly higher than the Experimental group. Even when only including those with BI = 20, it is clear that performance using the study tests varied considerably, and nearly one-third had quite low performance (Table 4.10).

Table 4.10: Physical ability between members of Groups 1 and 2, as depicted by animal icons (for those persons with BI = 20)

	Group 1: (Training) BI = 20 (N = 68 persons)		Group 2: (Control) BI = 20 (N = 35 persons)	
	N persons	%	N persons	%
Cheetah	4	6	1	3
Horse	25	37	14	40
Dog	17	25	13	37
Rabbit	18	26	6	17
Tortoise	4	6	1	3



4.3.1.3 Mean of the general characteristics of physical ability for Group 1 (Training) and Group 2 (Control) after three months of training

The results of the analysis show that, in Group 1 of the 100 participants in the initial sample, 13 participants had to withdraw before the end of the three months, leaving a net sample of 87 participants (38 males and 49 females). This group had a mean body weight and body mass index before the training program of 58.1 ± 11.2 Kg and 23.7 ± 3.6(Kg / m ^{2}), respectively. After 3 months of physical fitness training, body weight and body mass index were 58.3 ± 11.4 Kg and 23.9 ± 3.6. (Kg / m ^{2}), respectively.

In Group 2, of the original sample of 52 participants, seven had to drop out, leaving a net sample of 45 participants (21 males and 24 females). This group had mean body weight and body mass index before participating in the program = 59.2 ± 7.7 Kg and 24.1 ± 3.4 (Kg / m ^{2}), respectively. After three months, this group did not receive physical fitness training but could perform normal daily activities, and had body weight and body mass index = 59.5 ± 7.9 Kg and 24.3 ± 3.4 (Kg / m ^{2}), respectively.

In sum, there were no statistical differences in mean body weight and BMI before and after the three months of observations between and among the two groups.

Table 4.11: Mean physical condition of members of Groups 1 & 2 before and after the physical fitness training

	Group 1: Training (N=87)			**Group 2: Control (N = 45)**		
	Before	After	p value	Before	After	p value
Resting heart rate (bpm)	81±12	82±13	-	79±13	78±12	-
Systolic BP (mmHg)	138±19	132±19	-	134±18	130±20	-
Diastolic BP (mmHg)	74±10	74±12	-	73±10	74±12	-
Muscle mass (%)	39.3±7.8	39.5±7.8	-	39.9±6.1	40.2±6.4	-
Percentage of body fat (%)	27.9±8.7	27.8±9.0	-	28.4±9.7	28.1±10.1	-
Grip strength (kg)	21.0±7.3	24.2±7.7	P<0.01	21.5±7.4	23.8±7.4	P<0.01

In sum, there was a statistically significant difference in grip strength before and after the three months for both Control and Experimental groups, but no difference for the other indicators of physical fitness. (Table 4.11)

4.3.1.4 Mean percent difference in physical condition after three months of members of the Group 1 (Training), 59% had "better" physical condition compared to only 51% in the Group 1 (Control).

Table 4.12: Percent difference in physical condition ("Better," "No change," or "Worse") after three months of observation by Group 1 & 2

	Group 1: Training (N = 87 persons)	**Group 2: Control (N = 45 persons)**
	Difference (%)	Difference (%)
Better	59%	51%
No change	22%	22%
Worse	19%	27%

4.3.1.5. Comparison of physical ability, as represented by animal icons, before and after the training by Groups 1 and 2

As shown in Table 4.13, the point scores for physical fitness of the elderly as represented by an animal icon (noted for their relative speeds in nature) are grouped as follows: Cheetah:17-20; Horse: 14-16; Dog: 11-13; Rabbit: 8-10; and Tortoise 7 points or less. After the Group 1 practiced the SSM training for 3 months, it was found that the Tortoise group had 11 persons before training, but only six after training, or a 45% improvement. The Rabbit group before training had 20 participants; after training, the group declined to 11 participants, or an improvement of 45%. The number in the Dog group before training equaled 22 participants; after training, the group increased to 28 persons, representing a 27% improvement. The number in the Horse group before training was 30 participants; that increased to 31 participants after the training, or a 3% improvement. Before the training, there were four persons in the Cheetah group; that increased to 11 participants after three months, representing and improvement of 175%.

For members of the Control group, the numbers in the Cheetah and Horse groups increased by 300% and 19%, respectively. The numbers in the Dog, Rabbit, and Tortoise groups decreased by 22%, 14% and 33%, respectively.

In sum, the population with a faster/stronger physical body (i.e., Cheetah) had the most pronounced increase in physical performance, while those considered weaker/slower (Tortoise and Rabbit) had less improvement. These trends were similar in both Control and Experimental groups, perhaps because the research design did not control for the physical activities of the Control group.

Table 4.13: Comparison of physical ability, as represented by animal icons, before and after the training by Groups 1 and 2

	Group 1: Training (N = 87 persons)				**Group 2: Control (N = 45 persons)**		
	Before	After	Difference (%)		Before	After	Difference (%)
Cheetah	4	11	+175	**Cheetah**	1	4	+300
Horse	30	31	+3	**Horse**	16	19	+19
Dog	22	28	+27	**Dog**	18	14	-22
Rabbit	20	11	-45	**Rabbit**	7	6	-14
Tortoise	11	6	-45	**Tortoise**	3	2	-33

4.3.1.6 Comparison of mean percent change in physical ability, as represented by animal icons, before and after the training by Groups 1 and 2

Table 4.14 Summarizes the change in physical ability in terms of "better," no change" or "worse" by animal icon. In the Experimental group, in the Tortoise group, six had improved ability, for an improvement of 55%. For the Rabbit group, 15 participants had improved ability, for an improvement of 75%. For the Dog group, nine had improved ability, or 45%. For the Horse group, six had improved ability, for only 20%. For the Cheetahs, none had improved ability after three months.

In the Control group, the corresponding percent with improved ability for Tortoise, Rabbit, Dog, Horse, and Cheetah were 67%, 57%, 39%, 25%, and zero, respectively.

In sum, the elderly in the Control group had good physical performance, despite not receiving the three-month training. In the Experimental group, there was already good baseline fitness, but the training had more impact for those starting with lower physical ability.

Table 4.14: Change in percent physical ability by Group and animal icon

	Group 1: Training (N = 87 persons)				Group 2: Control (N = 45 persons)		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
Cheetah (n = 4)	0	4 (100%)	0	Cheetah (n = 1)	0	0	1 (100%)
Horse (n = 30)	6 (20%)	20 (67%)	4 (13%)	Horse (n = 16)	4 (25%)	10 (63%)	2 (12%)
Dog (n = 22)	9 (45%)	11 (55%)	2 (10%)	Dog (n = 18)	7 (39%)	9 (50%)	2 (11%)
Rabbit (n = 20)	15 (75%)	4 (20%)	1 (5%)	Rabbit (n = 7)	4 (57%)	3 (43%)	0
Tortoise (n = 11)	6 (55%)	5 (45%)	0	Tortoise (n = 3)	2 (67%)	1 (33%)	0

4.3.1.7. Mean percent change in physical ability by age group

The analysis of physical ability after the three months of the training show that there were clear improvements for those age 60-79 years, however, improvement diminished for those age 80 years or older (Table 4.15).

Table 4.15: Change in physical ability by age group, and Group 1 and 2

Age group	**Group 1: Training (N = 87 persons)**			Age group	**Group 2: Control** (N = 45 persons)		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
80+ (n = 5)	1 (20%)	3 (60%)	1 (20%)	80+ (n = 4)	1 (25%)	3 (75%)	0
75-79 (n = 13)	10(77%)	3 (23%)	0	75-79 (n = 5)	2 (40%)	3 (60%)	0
70-74 (n = 15)	3 (20%)	9 (60%)	3 (20%)	70-74 (n = 13)	6 (46%)	6 (46%)	1 (8%)
65-69 (n = 28)	9 (32%)	18 (64%)	1 (4%)	65-69 (n = 8)	5 (63%)	3 (37%)	0
60-64 (n = 26)	13 (50%)	11 (42%)	2 (8%)	60-64 (n = 15)	3 (20%)	8 (53%)	4 (27%)

4.3.1.8 Mean scores for physical ability by the four types of physical fitness testing by group before and after the three months of observation

The data in Table 4.16 show that there was a statistically significant improvement in performance for walking and posture change in the Experimental and Control groups, but the strength of the significance was much greater in the group receiving the training.

Table 4.16: Mean scores for physical ability by the four types of physical fitness testing by group before and after the three months of observation

	Group 1: Training (N = 87 persons)			Group 2: Control (N = 45 persons)		
	Before	After	statistical significance	Before	After	Statis-tical signifi-cance
Walking (seconds)	13.14±3.38	12.06±2.81	**0.0001*** **	12.60±2.57	11.91±2.70	**0.02***
Body movement (seconds)	7.83±2.90	7.78±2.11	-	7.94±1.94	7.73±2.39	-
Manual dexterity (seconds)	23.95±3.86	23.56±3.58	-	23.07±3.80	23.28±3.65	-
Posture change (seconds)	9.98±3.48	9.19±2.10	**0.0001*** **	9.75±2.39	9.20±2.42	**0.01***

4.3.1.9. Percent change in physical ability after three months for the four types of physical fitness testing, by group

For both Experimental and Control groups, the percent improvement ("better") was greatest for walking, followed by posture change. More members in the Experimental group reported better manual dexterity than for their counterparts in the Control group. The reverse was true for general body movement (Table 4.17).

Table 4.17: Percent change in physical ability after three months for the four types of physical fitness testing, by Group

Physical fitness testing	**Group 1: Training (N = 87 persons)**		**Group 2: Control (N = 45 persons)**	
	Better (%)	Worse (%)	Better (%)	Worse (%)
Walking	83%	17%	71%	29%
Posture change	69%	31%	62%	38%
Manual dexterity	55%	45%	42%	58%
Body movement	39%	61%	56%	44%

4.3.1.10 Assessed age before and after the three months of observation by type of physical fitness testing, by Groups 1 & 2

In the Experimental group, assessed age based on walking and posture change was lower than the person's actual age before and after the training. That was true only for walking for the Control group (Table 4.18).

Table 4.18: Assessed age before and after the three months of observation by type of physical fitness testing and Groups 1 & 2

Physical fitness testing	**Group 1: Training (N = 87 persons)**				**Group 2: Control (N = 45 persons)**		
	Actual age (yrs)	Assessed age before the training (yrs)	Assessed age after the training (yrs)		Actual age (yrs)	Assessed age before the training (yrs)	Assessed age after the training (yrs)
Walking	69	69	**68**		69	69	**68**
Posture change	69	69	**68**		69	68	68
Manual dexterity	69	70	70		69	69	70
Body movement	69	69	69		69	69	69

4.3.1.11 SSM-tested age compared with actual age after the three months of observation by Groups 1 & 2

After three months of training, the proportion of participants in the Experimental group who were assessed as younger-than-actual age increased from 56% to 69%. The comparable figures for the Control group are 62% and 69%.

In sum, both the Experimental and Control group members displayed better-than-average fitness for their age, but the increase was greater for the Experimental group (i.e., those with training) (Table 4.19)

Table 4.19: SSM-tested age compared with actual age) after the three months of observation by Groups 1 & 2

SSM-tested age	Group 1: Training (N = 87 persons)		Group 2: Control (N = 45 persons)	
	Before	After	Before	After
Less than actual age	56%	69%	62%	69%
Equal to or older than actual age	44%	31%	38%	31%

4.3.2 Dataset #2

This dataset includes the results of physical fitness training after the switch of participants from the Experimental group to the Control group (Group 1: Training to control; Control), and the change of the Control group into the Experimental group (Group 2: Control to train; Training). Data were collected data during April – June, 2019. In Group 1 (Training to control; Control) the number of participants declined from 87 participants to 74 participants due to drop-outs between Month 3 and Month 6. In the Control group (Group 2: Control to train; Training), three persons dropped out, reducing the sample size from 45 participants to 42 participants.

4.3.2.1. Mean and percent physical ability (by animal icon) in Group 2 (Training) and the Control after three months

Table 4.20 shows that there was more improvement in physical ability in the group receiving training than the Control group.

Table 4.20: Percent physical ability (by animal icon) in Group 2 (Training) after three months

	Group 1: Control (N = 74 persons)				Group 2: Training (N = 42 persons)		
	Before	After	Difference (%)		Before	After	Difference (%)
Cheetah	4	11	+175	**Cheetah**	1	7	+600
Horse	23	31	+35	**Horse**	15	18	+17
Dog	21	18	-18	**Dog**	16	10	-38
Rabbit	16	9	-44	**Rabbit**	7	6	-14
Tortoise	10	5	-50	**Tortoise**	3	1	-67

4. 3. 2. 2 Change in physical ability (better, no change, worse) after three months by animal icon and group

Table 4.21 shows that improvements in physical ability were similar for the Control and Experimental groups over three months.

Table 4. 21: Change in physical ability (better, no change, worse) after three months by animal icon and group

	Group 1: Control (N = 74 persons)				**Group 2: Training (N = 42 persons)**		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
Cheetah (n = 4)	0	3 (75%)	1 (25%)	Cheetah (n = 4)	0	2 (50%)	2 (50%)
Horse (n = 23)	8 (35%)	15 (65%)	0	Horse (n = 18)	5 (28%)	10(55%)	3 (17%)
Dog (n = 21)	11 (52%)	8 (38%)	2 (10%)	Dog (n = 12)	6 (50%)	4 (33%)	2 (17%)
Rabbit (n = 16)	13 (81%)	3 (19%)	0	Rabbit (n = 6)	3 (50%)	3 (50%)	0
Tortoise (n = 10)	5 (50%)	5 (50%)	0	Tortoise (n = 2)	1 (50%)	1 (50%)	0

4.3.2.3 Change in physical ability (better, no change, worse) after three months by age and Control and Experimental groups

The data in Table 4.22 show that, after three months, physical ability was "better" in the age group 60-79 years compared to those age 80 years or older.

Table 4.22: Change in physical ability (better, no change, worse) after three months by age and Control and Experimental groups

Age group	Group 1: Control (N = 74 persons)			Age group	Group 2: Training (N = 42 persons)		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
80+ (n = 4)	1 (25%)	3 (75%)	0	80+ (n = 3)	0	3 (100%)	0
75-79 (n = 11)	9 (82%)	2 (18%)	0	75-79 (n = 6)	2 (33%)	2 (33%)	2 (33%)
70-74 (n = 12)	3 (25%)	9 (75%)	0	70-74 (n = 12)	4 (33%)	5 (42%)	3 (25%)
65-69 (n = 23)	11 (48%)	10 (43%)	2 (9%)	65-69 (n = 8)	1 (13%)	6 (75%)	1 (13%)
60-64 (n = 24)	14 (58%)	10 (24%)	0	60-64 (n = 13)	8 (62%)	4 (31%)	1 (8%)

4.3.2.4 Change in physical ability by type of physical fitness after three months by Control and Experimental groups

The data in Table 4.23 show that walking, body movement, manual dexterity, and posture change improved, but there was no statistically significant difference for either Group 1 or Group 2.

Table 4.23: Change in physical ability by type of physical fitness after three months by Control and Experimental groups

Type of physical fitness	(Group 1: Control) (N = 74 persons)			(Group 2: Training) (N = 42 persons)		
	Before	After	statistical signifl cance	Before	After	Statisti cal signifl cance
walking (seconds)	12.94±2.81	11.92±2.48	-	11.95±2.67	11.73±2.42	-
body movement (seconds)	7.79±3.04	7.31±2.76	-	7.76±2.45	7.57±3.06	-
manual dexterity (seconds)	24.22±3.97	23.54±3.35	-	23.31±3.73	22.87±4.48	-
posture change (seconds)	9.86±2.85	8.93±2.58	-	9.24±2.41	8.99±2.60	-

4.3.2.5 Assessed and actual age by type of physical fitness before and after training by Groups 1 & 2

Data in Table 4.24 show that, for walking and posture change, assessed age was younger (by 1 to 2 years) after training than the actual age for both Groups 1 and 2.

Table 4.24: Assessed and actual age by type of physical fitness by Group 1 & 2

Type of physical fitness	**(Group 1: Control) (N = 74 persons)**			**(Group 2: Training) (N = 42 persons)**		
	Actual age	Assessed age before training	Assessed age after 3 months (no training)	Actual age	Assessed age before training	Assessed age after training
Walking	69	69	**68**	69	68	68
Posture change	69	67	**67**	69	68	67
Manual dexterity	69	70	68	69	70	70
Body movement	69	69	68	69	69	**69**

4.3.3. Dataset #3

This dataset contains a comparison of Dataset #1 (Group 1: Training) and Dataset # 2 (Group 2: Training).

4.3.3.1 Physical ability as compared between Dataset #1 and #2 after three months

The data in Table 4.25 show that the persons in Experimental groups 1 and 2 had more participants who were in the Cheetah (strong and fast) category after the training. By contrast, the number in the Tortoise category (slower, weaker) decreased.

Table 4.25: Physical ability (animal icons) as compared between Dataset #1 and #2 after three months by group

	Group 1: Training (N = 87 persons)				Group 2: Training (N = 42 persons)		
	Before	After	Difference (%)		Before	After	Difference (%)
Cheetah	4	11	+175	**Cheetah**	1	7	+600
Horse	30	31	+3	**Horse**	15	18	+17
Dog	22	28	+27	**Dog**	16	10	-38
Rabbit	20	11	-45	**Rabbit**	7	6	-14
Tortoise	11	6	-45	**Tortoise**	3	1	-67

4.3.3.2 Change in physical ability after training by Group 1 (Training) and Group 2 (Training) by animal icon

The data in Table 4.26 show that the participants in both groups had similar levels of change after three months, namely, the weaker elderly improved while the already-strong elderly stayed that way.

Table 4.26: Change in physical ability after training by Group 1 (Training) and Group 2 (Training) by animal icon

	Group 1: Training (N = 87 persons)				Group 2: Training (N = 42 persons)		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
Cheetah (n = 4)	0	4 (100%)	0	Cheetah (n = 4)	0	2 (50%)	2 (50%)
Horse (n = 30)	6 (20%)	20 (67%)	4 (13%)	Horse (n = 18)	5 (28%)	10 (55%)	3 (17%)
Dog (n = 22)	9 (45%)	11 (55%)	2 (10%)	Dog (n = 12)	6 (50%)	4 (33%)	2 (17%)
Rabbit (n = 20)	15 (75%)	4 (20%)	1 (5%)	Rabbit (n = 6)	3 (50%)	3 (50%)	0
Tortoise (n = 11)	6 (55%)	5 (45%)	0	Tortoise (n = 2)	1 (50%)	1 (50%)	0

4.3.3.3 Change in physical ability after training by Group 1 (Training) and Group 2 (Training) by age group

The data in Table 4.27 show that the members of both Groups #1 and #2 improved after the three-month training, but this was more pronounced in the age group 60-79 years. There was little improvement for those age 80 years or older.

Table 4.27: Change in physical ability after training by Group 1 (Training) and Group 2 (Training) by age group

Age group	Group 1: Training (N = 87 persons)			Age group	Group 2: Training (N = 42 persons)		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
80+ (n = 5)	1 (20%)	3 (60%)	1 (20%)	80+ (n = 3)	0	3 (100%)	0
75-79 (n = 13)	10 (77%)	3 (23%)	0	75-79 (n = 6)	2 (33%)	2 (33%)	2 (33%)
70-74 (n = 15)	3 (20%)	9 (60%)	3 (20%)	70-74 (n = 12)	4 (33%)	5 (42%)	3 (25%)
65-69 (n = 28)	9 (32%)	18 (64%)	1 (4%)	65-69 (n = 8)	1 (13%)	6 (75%)	1 (13%)
60-64 (n = 26)	13 (50%)	11 (42%)	2 (8%)	60-64 (n = 13)	8 (62%)	4 (31%)	1 (8%)

4.3.3.4 Change in physical ability after training by Group 1 (Training) and Group 2 (Training) by type of physical fitness

The data in Table 4.28 show that, for Group 1 (Training) there was a statistically significant improvement in walking (p = 0.0001) and posture change (p = 0.0001). By contrast, in Group 2 (Training), although there was positive change in these four types of physical fitness testing, none of the changes was statistically significant at three months.

Table 4.28: Change in physical ability after training by Group 1 (Training) and Group 2 (Training) by type of physical fitness

	Group 1: Training (N = 87 persons)			Group 2: Training (N = 42 persons)		
	Before	After	Statistical significance	Before	After	Statistical significance
Walking (seconds)	13.14±3.38	12.06±2.81	**0.0001*** **	11.95±2.67	11.73±2.42	-
Body movement (seconds)	7.83±2.90	7.78±2.11	-	7.76±2.45	7.57±3.06	-
Manual dexterity (seconds)	23.95±3.86	23.56±3.58	-	23.31±3.73	22.87±4.48	-
Posture change (seconds)	9.98±3.48	9.19±2.10	**0.0001*** **	9.24±2.41	8.99±2.60	-

4.3.3.5 Change (better or worse) in physical ability after training by Group 1 (Training) and Group 2 (Training) by type of physical fitness

The data in Table 4.29 show that, for Group 1 (Training) the best improvement occurred for walking (83%), followed by posture change (69%), manual dexterity (55%) and body movement (39%). By contrast, in Group 2 (Training) the training improved manual dexterity the most (70%), followed by posture change (63%), body movement (63%) and walking (56%).

Table 4.29: Change (better or worse) in physical ability after training by Group 1 (Training) and Group 2 (Training) by type of physical fitness

Movement type	Group 1: Training (N = 87 persons)		Group 2: Training (N = 42 persons)	
	Better (%)	Worse (%)	Better (%)	Worse (%)
Walking	83%	17%	56%	44%
Posture change	69%	31%	63%	37%
Manual dexterity	55%	45%	70%	30%
Body movement	39%	61%	63%	37%

4.3.3.6 Comparison of assessed and actual age by Group 1 (Training) and Group 2 (Training) after three months

Data in Table 4. 30 show that walking and posture change reflected younger assessed-age after the training in both groups.

Table 4.30: Comparison of assessed and actual age by Group 1 (Training) and Group 2 (Training) after three months

Type of physical fitness	**Group 1: Training) (N = 87 persons)**			**Group 2: Training) (N = 42 persons)**		
	Actual age	Assessed age before training	Assessed age after training	Actual age	Assessed age before training	Assessed age after training
Walking	69	69	**68**	69	68	68
Posture change	69	69	**68**	69	68	67
Manual dexterity	69	70	70	69	70	70
Body movement	69	69	69	69	69	**69**

Dataset # 4

The data in this dataset are compared with training effects at three time periods, i.e., Group 1 (Training) before training (Month 0), Month 3 (after 3 months of training) and at Month 6 (after stopping training for 3 months).

4.3.4.1. SSM-assessed vs. actual age at Month 3 and Month 6

Data in Table 4.31 show that before training (Month 0), three months after training (Month 3), and three months after stopping the training (Month 6), the SSM-assessed age was younger than the actual age: 56% to 69% and 68%, respectively. That suggests that the Experimental group became stronger or more physically able after just three months of training. This improvement declined at bit at three months after stopping the training, but was still better than at the baseline.

Table 4.31: SSM-assessed vs. actual age at Month 3 and Month 6

SSM-assessed age	Group 1		
	Before (Month 0) (n = 87)	Month 3 (n = 87)	Month 6 (n = 74)
Younger than actual (%)	56%	69%	68%
Equal to or older than actual age (%)	44%	31%	32%

4.3.4.2 Change in physical ability at Months 3 and 6

Data from Table 4.32 show that, after three months of training, 59% of the sample had improved physical ability. At six months, only 31% had worse physical ability.

Table 4.32: Change in physical ability at Months 3 and 6

(Group 1: Training)	**Difference (%)**	
	Month 3 (n = 87)	Month 6 (n = 74)
Better	59%	37%
No change	19%	32%
Worse	22%	31%

4.3.4.3 Overall physical ability for Group 1 (Training) at Months 0, 3, and 6

Data in Table 4.33 show that physical ability (represented by the animal icons) improved at three months, and stayed constant or declined slightly at three months after stopping the training.

Table 4.33: Overall physical ability for Group 1 (Training) at Months 0, 3, and 6

	Group 1: Training		
	Before (Month 0) (n = 87)	Month 3 (n = 87)	Month 6 (n = 74)
Cheetah	4	11	11
Horse	30	31	31
Dog	22	28	18
Rabbit	20	11	9
Tortoise	11	6	5

4.3.4.4 Physical ability for Group 1 (Training) at Months 0, 3, and 6 for females

Data from Table 4.34 show that physical ability for females improved after three months of training, and then declined three months later (after stopping training).

Table 4.34: Physical ability for Group 1 (Training) at Months 0, 3, and 6 for females

Females	**Group 1**		
	Before (Month 0) (n = 49)	Month 3 (n = 49)	Month 6 (n = 41)
Cheetah	4	9	8
Horse	19	16	19
Dog	13	18	9
Rabbit	9	5	4
Tortoise	4	1	1

4.3.4.5 Physical ability for Group 1 (Training) at Months 0, 3, and 6 for males

Data from Table 4.35 show that physical ability for females improved after three months of training, and then declined three months later (after stopping training).

Table 4.35: Physical ability for Group 1 (Training) at Months 0, 3, and 6 for males

Males	**Group 1**		
	Before (Month 0) (n = 38)	Month 3 (n = 38)	Month 6 (n = 33)
Cheetah	0	2	3
Horse	11	15	12
Dog	9	10	9
Rabbit	11	6	5
Tortoise	7	5	4

4.3.4.6 Change in physical ability (better, no change, worse) for Group (1: Training) at Month 3 (after training) and Month 6 (3 months after the end of training) by animal icon

Data in Table 4.36 show that, after three months of training, participants who had been classified as a Tortoise, Rabbit, Dog, or Horse improved from 20%-75%. Improvement at three months after the end of training occurred for those classified as Tortoise, Rabbit, Dog, or Horse from 35%- 81%. By contrast, one out of four Cheetahs had decreased physical ability.

Table 4.36: Change in physical ability (better, no change, worse) for Group (1: Training) at Month 3 (after training) and Month 6 (3 months after the end of training) by animal icon

	Month 3 (n = 87)				**Month 6 (n = 74)**		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
Cheetah (n = 4)	0	4 (100%)	0	Cheetah (n = 4)	0	3 (75%)	1 (25%)
Horse (n = 30)	6 (20%)	20 (67%)	4 (13%)	Horse (n = 23)	8 (35%)	15 (65%)	0
Dog (n = 22)	9 (45%)	11 (55%)	2 (10%)	Dog (n = 21)	11 (52%)	8 (38%)	2 (10%)
Rabbit (n = 20)	15 (75%)	4 (20%)	1 (5%)	Rabbit (n = 16)	13 (81%)	3 (19%)	0
Tortoise (n = 11)	6 (55%)	5 (45%)	0	Tortoise (n = 10)	5 (50%)	5 (50%)	0

4.3.4.7 Change in physical ability (better, no change, worse) for females in Group (1: Training) at Month 3 (after training) and Month 6 (3 months after the end of training) by animal icon

Data in Table 4.37 show that females classified as a Tortoise, Rabbit, Dog or Horse had improved physical ability from 21% - 78% after three months of training. These individuals had improved physical ability at three months after the end of training from 33%- 71%. By contrast, one out of four Cheetahs had decreased physical ability.

Table 4.37: Change in physical ability (better, no change, worse) for females in Group (1: Training) at Month 3 (after training) and Month 6 (3 months after the end of training) by animal icon

Females	Month 3 (n = 49)			Females	Month 6 (n = 41)		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
Cheetah (n = 4)	0	4 (100%)	0	Cheetah (n = 4)	0	3 (75%)	1 (25%)
Horse (n = 19)	4 (21%)	11 (58%)	4 (21%)	Horse (n = 15)	5 (33%)	10 (67%)	0
Dog (n = 13)	5 (39%)	7 (54%)	1 (7%)	Dog (n = 12)	6 (50%)	5 (42%)	1 (8%)
Rabbit (n = 9)	7 (78%)	2 (22%)	0	Rabbit (n = 7)	5 (71%)	2 (29%)	0
Tortoise (n = 4)	3 (75%)	1 (25%)	0	Tortoise (n = 3)	2 (67%)	1 (33%)	0

4.3.4.8 Change in physical ability (better, no change, worse) for males in Group (1: Training) at Month 3 (after training) and Month 6 (3 months after the end of training) by animal icon

Data in Table 4.38 show that males classified as a Tortoise, Rabbit, Dog or Horse had improved physical ability from 18%- 73% after three months of training. These individuals had improved physical ability at three months after the end of training from 38%- 89%. By contrast, no males qualified as Cheetahs.

Table 4.38: Change in physical ability (better, no change, worse) for females in Group (1: Training) at Month 3 (after training) and Month 6 (3 months after the end of training) by animal icon

Males	Month 3 (n = 38)			Males	Month 6 (n = 33)		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
Cheetah (n = 0)	0	0	0	Cheetah (n = 0)	0	0	0
Horse (n = 11)	2 (18%)	9 (82%)	0	Horse (n = 8)	3 (38%)	5 (62%)	0
Dog (n = 9)	4 (44%)	4 (44%)	1 (11%)	Dog (n = 9)	5 (56%)	3 (33%)	1 (11%)
Rabbit (n = 11)	8 (73%)	2 (18 %)	1 (9%)	Rabbit (n = 9)	8 (89%)	1 (11%)	0
Tortoise (n = 7)	3 (43%)	4 (57%)	0	Tortoise (n = 7)	3 (43%)	4 (57%)	0

4.3.4.9 Physical ability for those in Group 1 (Training) at Month 3 and Month 6 (3 months after the end of training) by age group

Data in Table 4.39 show that, after three months of training, from 20%-77% of participants had better physical ability. At three months after the end of training, fully 25%-82% had better physical ability.

Table 4.39: Physical ability for those in Group 1 (Training) at Month 3 and Month 6 (after the end of training at 3 months) by age group

Age group	Month 3 (N = 87)			Age group	Month 6 (N = 74)		
	Better (N, %)	No change (N, %)	Worse (N, %)		Better (N, %)	No change (N, %)	Worse (N, %)
80+ (n = 5)	1 (20%)	3 (60%)	1 (20%)	80+ (n = 4)	1 (25%)	3 (75%)	0
75-79 (n = 13)	10 (77%)	3 (23%)	0	75-79 (n = 11)	9 (82%)	2 (18%)	0
70-74 (n = 15)	3 (20%)	9 (60%)	3 (20%)	70-74 (n = 12)	3 (25%)	9 (75%)	0
65-69 (n = 28)	9 (32%)	18 (64%)	1 (4%)	65-69 (n = 23)	11 (48%)	10 (43%)	2 (9%)
60-64 (n = 26)	13 (50%)	11 (42%)	2 (8%)	60-64 (n = 24)	14 (58%)	10 (24%)	0

4.3.4.10 Physical ability for those in Group 1 (Training) at Month 3 and Month 6 (at 3 months after the end of training) by type of physical ability

Data from Table 4.40 show that after the training, walking and posture change were "better," and this change was statistically significantly better than at Months 3 and 6. Body movement was also significantly better at Month 6.

Table 4.40: Physical ability for those in Group 1 (Training) at Month 3 and Month 6 (3 months after the end of training) by type of physical ability (duration in seconds)

Type of physical ability	Before training (Month 0) (N = 87)	Month 3 (N = 87)	Month 6 (N = 74)
Walking (seconds)	13.2±3.4	12.1±2.8*	11.9±2.5*
Body movement (seconds)	7.8±2.9	7.8±2.1	7.3±2.8*[a]
Manual dexterity (seconds)	24.0±3.8	23.5±3.5	23.5±3.4
Posture change (seconds)	10.0±2.8	9.2±2.1*	8.9±2.6*

***p < 0.05** in comparison at Month 0; [a] p< 0.05 in comparison with Month 3*

Data in Table 4.41 show that physical ability in walking, posture change, and manual dexterity were “better” for over half the sample at Months 3 and 6. However, there is a need for more improvement in body movement, for which only 39% of respondents had better ability at three months.

Table 4.41: Physical ability for those in Group 1 (Training) at Month 3 and Month 6 (3 months after the end of training) by type of physical ability

Type of physical ability	**Month 3 (n = 87 persons)**		**Month 6 (n = 74 persons)**	
	Better (%)	Worse (%)	Better (%)	Worse (%)
Walking	84%	16%	82%	18%
Posture change	69%	31%	61%	39%
Manual dexterity	55%	45%	58%	42%
Body movement	39%	61%	78%	22%

4.3.4.11 SSM-assessed age and actual age for members of Group 1 (Training) at Month 3 (3 months after training) and Month 6 (3 months after the end of training) by type of physical ability

The data in Table 4.42 show that, for walking, and posture change, assessed age was younger than actual age by one year at the end of three months of training. Indeed, even at three months after the end of the training, this sample had an ability in walking, posture change, manual dexterity, and body movement that reflected a person who was one year younger than they actually were. This suggests that there is a sustained impact of the SSM program that extends beyond the period after formal training ends.

Table 4.42: SSM-assessed age and actual age for members of Group 1 (Training) at Month 3 (3 months after training) and Month 6 (3 months after the end of training) by type of physical ability

Type of physical ability	Group 1: Training			
	Actual age	Assessed age at Month 0	Assessed age at Month 3	Assessed age at Month 6
Walking	69	69	68	68
Posture change	69	69	68	67
Manual dexterity	69	70	70	68
Body movement	69	69	69	68

Chapter 5

Summary and Discussion

This chapter presents a summary of findings, a discussion of standard scores of physical abilities of Thai elderly, and an analysis of the results of a pilot project to assess the effectiveness of the SSM Program. The chapter concludes with recommendations for action going forward.

5. 1 Summary of findings and discussion of standard scores of physical abilities of Thai elderly

Data were collected from 560 population age 60 and older, 265 males and 295 females, divided into 453 persons who scored equal or over 15 out of 20 on the Barthel Index test (BI≥ 15) and 107 who scored from BI = 12-14. (Note: A higher BI score indicates better physical agility and ability to carry out activities in daily living, or ADLs.) Analysis took into consideration the sample sizes, and there was aggregation of participants by five-year age groups: 60-64, 65-69, 70-74, 75-79 and 80 years or older.

The study found that:

- For both elderly males and females, the average amount of time required to perform tests of the four types of movement increases with increasing age.
- For both elderly males and females, the test of general bodily movement required the least amount of time, followed by the ability to change postures, walking, and manual dexterity.
- Male elderly had better ability to perform all tests of physical ability (i.e., spent less time to complete) than female elderly.

Observations and suggestions

Researchers should be careful to ensure that there are enough participants in each age group, especially the age range of 75 to79 year old and those age 80 years or older.

5.2 Summary and discussion of Dataset #1: 3 months of training: January-March, 2019

Dataset #1: For this dataset, data were collected from January till March in 2019, and these data allow a comparison of the effect of the SSM program for physical training over a three-month period. Fully 152 study participants were randomly allocated into Training (N=100) and Control (N=52) groups. Participants in the Experimental group implemented the SSM training program for three months under the guidance of an SSM Master. The regimen included 60-90 minutes of training every two weeks with the SSM Master, followed by at-home implementation for 30-60 minutes 2-3 days a week. Participants were given a training handbook to guide them on the activities. Participants were followed up to see if they could replicate the training regimen and to what extent they performed the activities. They were asked if they completed all the routines, and which routines they were unable to perform. Initially, participants in the Control group did not receive the SSM training, yet they were allowed to perform physical activity in the course of ADLS. Participants were assessed for four types of physical movement: walking, posture change, manual dexterity, and bodily movement. The assessment was done before the training (Month 0) and after three months (Month 3).

Some participants had to withdraw from the Pilot Project during implementation. Thus, the final sample with complete data for the period of January to March, 2019 comprised 132 individuals: 87 in the Experimental group, and 45 in the Control group.

Dataset # 1 Comparison of findings before and after the training

1. Values for general physical ability did not change significantly, except for grip force, which improved significantly in both in the Experimental and Control groups;

2. After 3 months of training, the proportion of participants in the Experimental group whose SSM-assessed age was younger than their actual age increased from 56% to 69%. This may indicate that the 3-month SSM training program helps to improve physical ability more than those in a Control group;

3. The percent of participants who had "better" physical performance after 3 months of training in the Experimental group (Group 1: Training) was 59%, compared to only 51% in the Control group (Group 2: Control);

4. The average physical fitness in the Experimental group (Group 1: Training) after the 3 months of SSM training (as represented by animal icons), found that the number of participants classified as Cheetahs (fast, strong) increased. Correspondingly, those classified as Tortoises and Rabbits (less strong, fast) declined in number, compared to the changes in the Control group. This may indicate that the SSM program had a positive impact on physical performance;

5. The average physical ability in the Experimental group (Group 1: Training) after 3 months, classified by age, found that the SSM program had a more pronounced effect for the population age 60-79 years, compared with those age 80 years or older;

6. The average percentage of change after the three months of observation found that the elderly who did not receive the training had declining physical performance, though they were still considered physically fit. By contrast, those who participated in the SSM program training had increased speed/strength for those who initially tested lower, and maintained high levels of performance for those who tested physically fit at Month 0.

7. When comparing change in type of movement, the pre-post comparison found that the SSM program had more impact on walking ability (83%). The impact on the other types of movement were less pronounced, e.g., for posture change ability (69%), manual dexterity (55%) and general bodily movement (39%).

8. When testing for statistical significance, the analysis found that the participants in Group 1 (training, Experimental) had improved walking ability ($p = 0.0001$) and posture change ability ($p = 0.0001$). However, participants in the Control group (Group 2: Control) also had significant improvements in those areas (though the level of statistical significance was considerably lower, i.e., $p = 0.02$ and $p = 0.01$, respectively).

Observations of the results from the Dataset #1 analysis

1. This research design did not restrict the Control group (Group 2: Control) from exercising in the performance of ADLS during the three months of SSM training in the Experimental group. Thus, it is possible that their level of activity was higher on physical fitness, and thus had improvements that were statistically significant, though not as statistically strong as in the Experimental group.
2. The level of intensity in this application of the SSM training was relatively light (in order to protect the safety of the elderly). Thus, changes in physical ability may have been less pronounced than they could have been if a more intense training was conducted.
3. The approach to the SSM training in the Thai setting was to make the exercises fun and recreational. That was done in order to promote good relationships among participants, and encourage the less-assertive members to actively participate and socialize, since that is another form of quality-of-life enhancement.

Recommendations

1. If the intent is to more-precisely the extent to which the SSM program is superior to other types of training in physical ability for the elderly, then there would need to be data collection on the level of activity in the group which did not receive the training in order to control for the effects of external influences on performance.
2. There should be extra "doses" of fitness training for the frail group of elderly since these individuals (e.g., Tortoise and Rabbit) may need more external support to improve physical ability.

Dataset #2 contains results of the crossover design whereby participants who were originally in the Experimental group (Training), switched places with the Control group (Non-training). In this way, all participants had a chance to receive the SSM training. Data for Dataset#2 was collected from April till June in 2019. In sum, the findings were similar for Dataset #1. That is, the Experimental group had superior performance for physical ability than the Control group.

Dataset #3 confirms that there was a significant effect of the SSM training on physical ability of the elderly participants when comparing Experimental and Control groups.

5.3 Summary and discussion

Dataset #4 includes data on follow-up of participants three months after the end of training (Month 6)

Inevitably, there was additional drop-out from the study sample when the observation period was extended to three months after the end of the training component in June. Thus, the final net sample with a complete data set was 74 individuals.

The follow-up of participants at three months after the end of the training yielded the following:

1. Despite having many months elapsed since the end of the SSM training, the proportion of the sample whose SSM-assessed age was less than their actual age was still high (69% vs. 68%). This suggests that, on the whole, the effect of the SSM training is sustained over time, even though there might be a slight trail-off of the effect.
2. In terms of the assessment of physical ability, the follow-up found that the proportion of participants who were rated "better" at the end of training had declined to 37% three months later.
3. When viewed as animal icons, the proportion of participants who were re-classified into a less-fast or less-strong animal at the end of training was 10%-25%; those proportions decreased to 5%-13% at three months after the end of training, i.e., a smaller level of degradation.
4. The proportion of female participants classified as Tortoise, Rabbit, Dog, or Horse increased from 21%-78% at the end of the three months of training. At three months after the end of training, the corresponding percentages ranged from 33%-77%, respectively. One out of four female participants classified as Cheetahs had declining performance.
5. The proportion of male participants classified as Tortoise, Rabbit, Dog, or Horse increased from 18%-73% at the end of the three months of training. At three months after the end of training, the corresponding percentages ranged from 38%-89%, respectively. There were no males classified as Cheetahs at Month 6.

6. At three months after the end of training, the proportion of participants with physical ability comparable to the point of time at the end of training was similar for all age groups.
7. At the end of training (Month 3) and three months after the end of training (Month 6), ability in walking, posture change, and bodily movement was better than at Month 0, and those differences were statistically significant.
8. SSM-assessed age was younger than actual age (by about one year each) at three months after the end of training as measured by walking, posture change, manual dexterity, and bodily movement.

In sum, even at three months after the end of training, the positive effects of the SSM program were still evident, even though there was some back-sliding.

Observations of the results of the follow-up of participants at three months after the end of training

1. It is apparent that most of the original participants in the SSM program saw the benefit of the training since they continued to practice the exercises over time.
2. The regimen of SSM exercises is basic enough that individuals can perform these easily at home, even without a trainer present.

5.4 Summary and Recommendations

The Japanese SSM program can help elderly Thais to improve their physical movement ability, and those types of movement are important for performing activities in daily living (ADLS), i.e., living a self-reliant life. This study found particularly strong improvements in walking and posture change (transfer) from the SSM program as applied to elderly Thais. These skills help prevent accidental falls and related injuries. This research also found that the SSM training is even more effective for those with a baseline level of lower physical ability. That is especially important in delaying dependence of these individuals on others for ADLS.

Thus, the researchers conclude that the Japanese model of SSM training – which is easy to learn and not overly strenuous – can be applied effectively and safely for Thai elderly. Accordingly, the SSM program should be replicated for all elderly throughout the country.

However, this study includes only three provinces in the Northeast (Udon Thani, Nongkhai, and Nong Bua Lamphu). Due to sociodemographic and economic differences among the 5 regions in Thailand (Bangkok, Central, North, Northeast and South), the SSM program should be replicated in the other regions, including an updated standard of physical ability for the Thai elderly in the whole country, implementation of the SSM program, and follow-up assessment.

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Appendix

WORKING COMMITTEE OF THE REPORT ON VERIFICATION SURVEY WITH THE PRIVATE SECTOR FOR DISSEMINATING JAPANESE TECHNOLOGIES FOR HEALTH PROMOTION FOR THE ELDERLY BY APPLYING JAPAN' S PREVENTIVE CARE SYSTEM

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