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A cross-sectional population study compared with a Swedish study

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To everybody who wants to know,
To my Mom and Dad because of all their generosity,
To my husband because of his sincere accompaniment,

And
To my son because of his patience, understanding and assistance.

ABSTRACT

Background: Population ageing is highly complex and varies with the context. For instance, people's health can be influenced by behavioral and cultural factors and economic resources. Cross-national comparisons are helpful when exploring these factors.

Aims: To provide a Persian version of the Falls Efficacy Scale, Swedish version (FES(S)) and explore its validity and reliability in an Iranian population.

To investigate whether Iranian 75-year-olds differ from their Swedish peers with respect to physical activity level, physical performance and certain health-related factors.

To explore if walking for at least 30 min a day is related to health, fitness, physiological capacity and functional performance in older Iranians.

To establish whether health-related behavior (HRB) and independence (I) intermediate the link between the socioeconomic status (SES) and the health status (HS) of older adults in Iran.

Material and methods: A representative sample of 637 Swedish 75-year olds, from the longitudinal Gerontological and Geriatric Population Studies in Gothenburg, and an Iranian sample of 851 75-year-olds, living in Tehran, were included. Physical activity level, health-related factors, and the results of functional tests including walking speed, muscle strength and balance function were evaluated. SPSS and Mplus 5 softwares were used for data analysis.

Results: The Persian FES (S) was shown to be a culturally relevant, valid, and reliable tool for measuring fall-related self-perceived confidence in Iranian older adults. Iranian 75-year-olds had a lower physical activity level, a worse physical function apart from a better grip strength, a worse physical health status but smoked less than their Swedish counterparts. There were no differences between the two cohorts regarding vertigo or falls. The extent of gender differences was about the same in most aspects and to the disadvantage of women. Iranian old people who walked at least 30 minutes daily/almost daily were better in most health-related outcomes, ADL and functional performance than people who walked less. A structural equation model showed that older people with a high SES had a higher level of physical activity and were more independent in ADL than others. SES was a positive predictor of HS, not directly but through the intermediation of HRB and I.

Conclusions: The Persian version of FES(S) was shown to be a valid and reliable tool. 75-year-old Iranians were less physically active than their Swedish peers and their functional performance, apart from grip strength, was worse, while similar gender differences were found, mainly to the advantage of men. Iranians who took a daily walk of at least 30 min a day showed better results in most health-related outcomes, ADL and functional performance than persons who walked less. As physical activity is a strong determinant of functional performance and health, activities like taking a daily walk of at least 30 minutes should be promoted. Gender-specific discrepancies found in relation to physical activity and performance call for longitudinal studies to clarify the causes.

Keywords: Old people, Physical activity, Performance, Function, Health, Cross-cultural, ADL

LIST OF PUBLICATIONS

This thesis is based on the following papers, which will be referred to in the text by Roman numerals (I-IV).

I. Zahra Mosallanezhad, Mahyar Salavati, Karin Hellström, Gholam Reza Sotoudeh, Lena Nilsson Wikmar, Kerstin Frändin.
Cross-Cultural adaptation, reliability and validity of the Persian version of the modified falls efficacy scale.
Disability and Rehabilitation, 2011; 33(25–26): 2446–2453

II. Zahra Mosallanezhad, Helena Hörder, Mahyar Salavati, Lena Nilsson-Wikmar, Kerstin Frändin.
Physical activity and physical functioning in Swedish and Iranian 75-year-olds – A Comparison. Arch Gerontol Geriatr. 2012 Mar 16 [Epub ahead of print].

III. Zahra Mosallanezhad, Mahyar Salavati, Gholam Reza Sotoudeh, Lena Nilsson Wikmar, Kerstin Frändin.
Walking Habits and Health-Related Factors in 75-year-old Iranian Women and Men (submitted).

IV. Zahra Mosallanezhad, Gholam Reza Sotoudeh, Mahyar Salavati, Karin Harms-Ringdahl, Lena Nilsson Wikmar, Kerstin Frändin.
A structural equation model of the relation between socioeconomic status, health-related behavior, independence and health status in older Iranian people (manuscript).

Studies III and IV. These may not be the final versions before publication.

CONTENTS

LIST OF ABBREVIATIONS

ADL	Activities of Daily Living
ACSM	American College of Sports Medicine
BMI	Body Mass Index
CDCP	Centers for Disease Control and Prevention
CI	Confidence Intervals
DSM	Diagnostic and Statistical Manual of Mental Disorders
FES	Falls-Efficacy Scale
GFI	Goodness of Fit Index
HRB	Health Related Behavior
HS	Health Status
I-ADL	Instrumental Activities of Daily Living
NCDs	Non-Communicable Diseases
NW	Non-Walkers
OR	Odds Ratio
PA	Physical Activity
P-ADL	Personal Activities of Daily Living
QOL	Quality of Life
SEM	Standard Error Measure
SES	Socio-Economic Status
SPSS	Statistical Package for the Social Sciences
USWR	University of Social Welfare and Rehabilitation Sciences
W	Walkers
WHO	World Health Organization

1 Introduction

Human aging involves inevitable and irreversible changes in most parts of the body but in a highly complex and individual pattern [1,2]. It is a dynamic process that starts at birth and continues throughout life [3]. From a functional point of view, ageing is considered to be accompanied by progressive and generalized loss of function, increasing the risk of age-related injury and disease. Consequently, it can result in loss of equilibrium and appropriate adaptive responses in different necessary situations of activities of daily living (ADL) [4]. These changes comprise a set of the genetically biological processes, but the final outcome is influenced by a combination of genetics, environmental, lifestyle, and other inducing aspects related to individual and societal characteristics [5]. Reaching old age provides more exposure to external, behavioral and environmental factors which may cause disease or injury and lead to functional decline [6]. However, there is evidence that lifestyle, (i.e. being physically active, non-smoking, use a limited amount of medications), personal coping skills and social networks can effectively modify the impact of genetics on functional decline and the probability of disease and injury occurring [7].

The key necessities for successful ageing and satisfaction in old age are remaining active (physically and intellectually) and have a satisfying social life [5,7]. The activity theory emphasizes that an older person can overcome the limitations related to old age by continuing an active lifestyle [8,9]. An improvement in self- efficacy and a positive self-image, new roles, interests, and relationships should replace factors that are diminished or lost in late life. Community attitudes toward ageing and old people should also be modulated; old age is a continuing period of life and is not necessarily accompanied by functional loss and limited social participation. The activity theory highlights providing many opportunities for elderly people to participate in society in an effective and meaningful way [8]. Improvement in general health and wealth in the older population also facilitates staying active more easily than in the past decades. And activity itself can develop different features of wellbeing [9,10].

Psychological issues across the life, socio-economic and environmental factors also have a strong impact on the way in which people age. Physical and cognitive health and functioning, participation and security are essential determinants that affect the overall wellbeing and quality of life (QOL) of elderly people. These aspects can be influenced by improvement in psychological aspects (i.e. confidence, self-efficacy and motivation) as well as socio-economic factors (i.e. social support, opportunities for education and lifelong learning, peace, protection from violence and abuse, economic status) [9-12]. A safe and friendly living environment without physical barriers encourages elderly people to actively participate in group activities, exercise and social networks. It will decrease the risk of isolation, depression, reduced fitness and mobility problems [13,14].

The present thesis aimed at providing a perspective on the current situation of older people in Iran regarding their physical activity level and functional performance and to compare them with their Swedish peers. The studies included are the result of good international collaboration to share knowledge and experiences between the two

countries of Iran and Sweden. This cooperation can help to identify both protective and risky influencing factors in physical performance and independence in older people and facilitate the planning of appropriate intervention programs to improve health and quality of life. Due to different life styles and cultural circumstances, it was necessary to use culturally adapted assessment tools. The first study explains the procedure of standard translation and validity/reliability valuation of an instrument used for the study in Iran. The second study presents the result of comparing physical activity and physical functioning between Swedish and Iranian 75-year-olds. The third study aimed to reveal if Iranian old people who walk according to the recommendations supported by WHO, the Centers for Disease Control and Prevention (CDCP) and the American College of Sports Medicine (ACSM) [15,16] have a better health, independence and functional performance than those who are less active. The fourth study demonstrates a structural model of the relation between socioeconomic status, health-related behavior, independence and health status in Iranian older people.

1.1 Population ageing, a global phenomenon

The age group comprising people of 60 years and over is growing faster than any other age groups in most countries around the world (Figure 1) [17]. Successful public health policies and socioeconomic growth have facilitated reaching old age; never before have there been so many old people in the world. Nevertheless, society is now being challenged to adapt to the needs and demands of this age group. The size of the population over the age of 60 will reach about 1.2 billion by 2025 and 2 billion by 2050, and the developing countries will have the largest share [18,19].

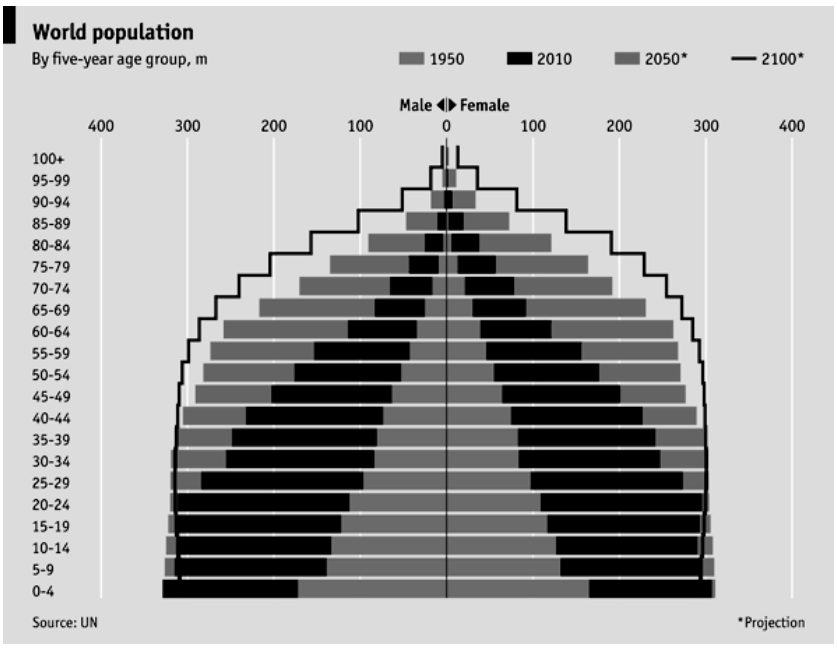

Figure 1. Worldwide population pyramid of 1950 compared to a more cylinder-like population structure in 2050 and 2100. Source: United Nations 2001 [17].

The percentage of people aged 60 years in the world population was 10% in 2000 but will reach nearly 22% by 2050. By that time it will be nearly equal to the proportion of children (0-14 years). In 2000, the proportion of old persons of 60+ in the population was much higher (20%) in the more developed regions than in the less developed ones (8%). By 2050, the proportion in more developed regions will be 33%, in less developed regions 21%, and the least developed countries 12%.

If we look at the actual population figures and compare regions it is obvious that the greatest number of older people live in Asia; Asia's share of the older population will increase to 63 % by 2050, while that of Europe will show the greatest relative decrease of any region, shrinking from 24 % in 2000 to 11 % by 2050 (Figure 2) [20].

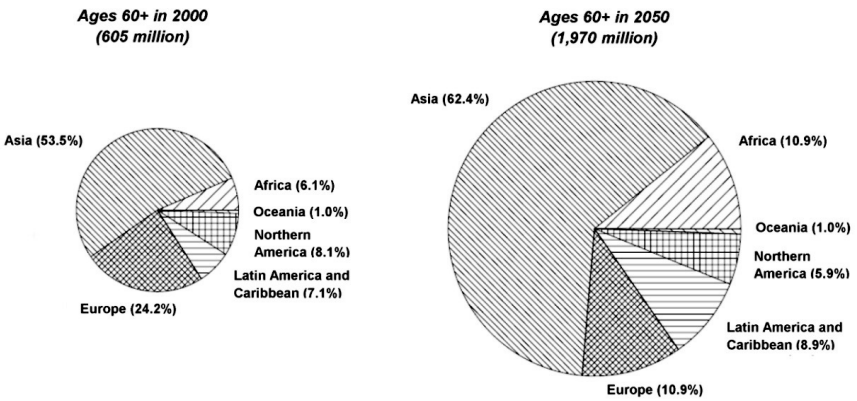

Figure 2. Comparison regarding the distribution of the world population over the age of 60 by region, 2000 and 2050. Source: United Nations 2001 [20,21].

In Iran, an Asian country, a shift in the age distribution has begun; it is now in a transitional period from a young to middle-aged population [22]. Based on the last Iranian census in 2011, a life expectancy of 74.6 and 72.1 has been registered for Iranian women and men, respectively [22,23], and the proportion of old people in the population is estimated to be about 7.3 percent in 2012, but will reach about 21 percent by 2050 [22]. Most older people in Iran live with their families or in their own homes, and there is little demand for, or impetus to obtain, institutional care. Although the health and social authorities in Iran have given the greatest priority to the wants and needs of the larger young population policies, they have recently started to emphasize preprograming and attention to the growing old segment of the population [24].

In Sweden, a European country with a life expectancy of 83 years for women and 79 for men [25], 18% of the population were ≥65 years in 2010 [26], of which 5.3% were ≥80 years [27]. This represents the highest proportion of persons over 80 years in the world. The majority of these are women who live alone in their own homes [28].

1.2 Ageing population challenges and significance of the present thesis

Along with industrialization, developing countries like Iran will be faced with an alteration in disease patterns, namely, a rapid growth of non-communicable diseases (NCDs) [29]. This may lead to new extensive demands and attract resources [30]. Chronic diseases in both developing and developed countries can result in physical or mental disability, which can in turn threaten the older person's independence in activities of daily living and participation. People with disabilities are more likely to be affected by the changes related to the ageing process. A big challenge for the health policy-makers regarding the ageing phenomenon in Iran could be to prevent or manage these NCDs and related disabilities. To create a balance among the supportive and care systems to meet the needs of elderly people is also another priority [30]. Feminization of ageing (higher ratio of women versus men in older age groups almost everywhere) [31], ethical questions related to research on ageing and longevity with higher QOL (genetic and manipulation, biotechnology, the use of stem cells and technology) [32] and the economic cost of an ageing population are other challenging aspects [33]. Among the main concerns that policy makers have debated is the fear that rapid population ageing may lead to an unmanageable explosion in health care and social security costs [33,34]. Traditionally, old age has increased the risk of diseases and injury and consequently dependency [35]. Retirement can also lead to less social participation and more strain on resources.

The ageing population in Iran and related challenges raise many fundamental questions for policy-makers about how to reinforce health promotion and prevention strategies, especially those directed towards older people. How should they help people to remain independent and active as they age? To develop feasible action plans to improve the health, function and QOL of elderly people in Iran, population-based evidence is needed. A review of the current situation and comparisons with other countries that have been faced with and managed similar problems previously can speed up the procedures regarding plans and interventions. Information on health and functional differences can help to highlight both protective and risk factors in different societies. Sharing knowledge and experience can promote the process. However, there are limited numbers of comparison studies between countries, one reason being that they are hard to carry out due to differences in definitions, methods and operationalization, when measuring health-related outcomes [36], in particular regarding disability and functional limitations [37].

1.3 Defenitions of concepts used in this thesis

1.3.1 Active ageing

"Active ageing" refers to providing opportunities in both individual and population group levels to promote health, participation and security in order to enhance quality of life when people age. Active ageing help people to recognize their potential for physical, social, and mental well-being throughout the life course and to participate in society[38], while adequate protection, security and care are provided for them when needed. The word "active" refers to continuing participation in social, economic, cultural, spiritual and civic affairs, not just the ability to be physically active or to

participate in the labor force. Older people who retire from work, are ill or live with disabilities can remain active contributors to their families, peers, communities and nations. Active ageing aims to extend healthy life expectancy and quality of life for all people as they age [38,39].

1.3.2 Health

"Health" refers to physical, mental and social well-being as expressed in the WHO definition of health. Maintaining the autonomy and independence of older people is a key goal in the policy framework for active ageing [39]. In such a framework, policies and programs that promote mental health and social connections are as important as those that improve physical health status.

1.3.3 Independence

"Independence" is commonly understood as the ability to perform functions related to daily living, i.e. the capacity of living independently in the community, with no or little help from others. Maintaining autonomy and independence as one grows older is a key goal for both individuals and policy makers [39,40]. Moreover, ageing takes place within the context of others – friends, work associates, neighbors and family members. This is why interdependence as well as intergenerational solidarity (two-way giving and receiving between individuals as well as older and younger generations) are important tenets of active ageing [38,40].

1.3.4 Physical activity, exercise and physical fitness

"Physical activity", "Exercise" and "Physical fitness" are terms that describe different concepts. However, they are often mixed up with one another, and the terms are sometimes used interchangeably. Physical activity is defined as any bodily movement, produced by skeletal muscles, that results in energy expenditure. The energy expenditure can be measured in kilocalories. Physical activity in daily life can be categorized as occupational, sports, conditioning, household, or other activities. Exercise is a subset of physical activity that is planned, structured, and repetitive, and its final or intermediate objective is the improvement or maintenance of physical fitness. Physical fitness is a set of attributes that are either health- or skill-related. The degree to which people have these attributes can be measured with specific tests [41].

1.3.5 Functional performance

Functional performance refers to essential physical and mental activities of daily life that direct the overall abilities of body and mind to do purposeful 'work' such as walking, lifting objects, climbing stairs etc. A wide variety of procedures have been used to measure functional performance, for instance self-reports or proxy reports, interviewers' observations, counts of steps and the number of repetitions before fatigue, and equipment-based evaluation of performance [42]. Present procedures combine interviewer ratings, counts and timed tasks.

1.3.6 ADL

The term “activities of daily living” refer to a set of common, everyday tasks that are required for personal self-care and independent living. The most often used measure of functional ability is the Katz Activities of Daily Living Scale [43]. PADL-scales assess the basic capacity of persons to care for themselves. IADL-scales are used to assess somewhat higher levels of performance, such as the ability to perform household routines or go shopping [44].

1.4 Old stage of life

The improvement in social and health care services, an increased quality of life, a longer life expectancy and lower birth rates in the past decades have contributed to the increasing proportion of elderly people globally [39]. The risk of developing disability increases with age. Based on estimates by WHO [45], 20% of persons older than 70 years and 50% of those over 85 have some form of disability. Considering the rate of disability, the age of 75 is viewed as the starting point of old age [45]. Heterogenic characteristics of old people, varying health-related behavior and socio-economic circumstances among nations lead to different rates of disability worldwide. For example, severe disability is declining in the US, Italy and the Netherlands, is stable in Australia and Canada but increasing in Sweden and Japan [46].

Old age can be associated with postural instability and limitations of personal abilities leading to dependence on others and a need for more health and social services. A major cause of disablement at this age is the fall accident [47,48]. Research confirms that falling is a major public health problem that can lead to substantial medical and economic consequences and also to disability [49]. The number of falls increases progressively with age in both sexes, in both rural and urban areas, and in all racial and ethnic groups [50,51]. Many physical and psychological consequences of falls in elderly people, including postural instability, avoidance of activity, functional decline in activities of daily living (ADL), loss of independence, increased risk of falling, fear of falling (FOF) and loss of confidence, have been reported [52-56].

The fall-related psychological consequences such as FOF have been shown to be even more disabling than the fall itself, leading to more demands on health care facilities [56,57]. Early detection of persons at risk and measurement of these consequences have been among the main targets of the fall prevention trials and rehabilitation strategies [58-60]. In this field, the most valid and reliable instruments are the Falls Efficacy Scale (FES) and its modified versions. This scale has been commonly used to assess fall-related self-efficacy in different countries with varying cultures and languages. Many studies have shown a good test-retest reliability and high internal consistency for this instrument and its modified versions [61-66].

1.4.1 Determinants of active ageing

An active life style can postpone the ageing process, prevent many aspects of functional decline, and improve health and QOL [67-71]. A combination of individual, family and national determinants, including those of a personal, behavioral physical social and economic nature, can ensure or prevent active aging [68]. Other determinants comprise

health and social services, gender and culture and an appropriate environment where seniors can have access to programs and services that satisfy their needs and interests (Figure 3) [9]. In this outline persons who achieve optimal age are those who stay active. Active ageing implies the maintenance of regular activities, roles, and social pursuits. Recognizing seniors with a variety of skills, knowledge and experiences, changing their roles and finding substitute activities in these new roles will help them to achieve the goal of active ageing. To design effective policies and programs to achieve active ageing we need to understand and work on all the determinants described above and summarized in Figure 3 below.

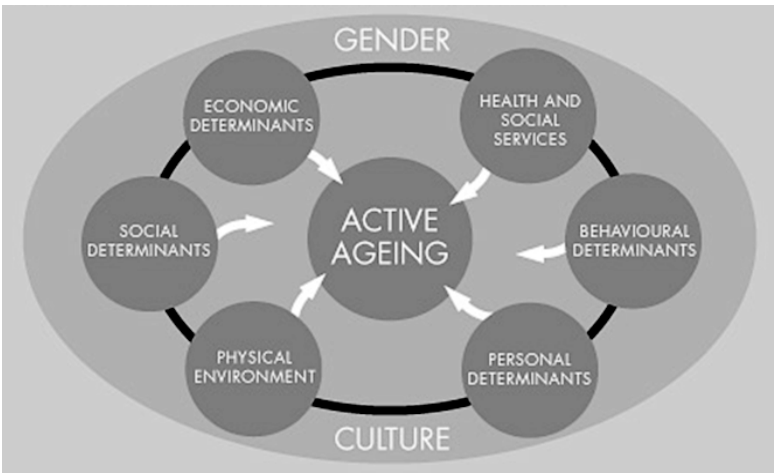

Figure 3. The determinants of Active Ageing.
Source: http://wisdom.unu.edu/en/active-aging/ [9].

Self-assessed global health is an independent predictor of mortality, morbidity and functioning in community-living older people [72]. Social and economic discrepancies that contribute to the unequal distribution of health-related factors, disability, morbidity and mortality have also been demonstrated [73-75]. There is a link between health status (HS) and the interaction of different dimensions of socio-economic status (SES) (individual characteristics, urban neighborhood, cities and countries) [73,75] and cultural resources (comprehension, attitudes and behavior) influences [74]. It has been pointed out that numerous intermediating factors are involved in this link [73,75].

Physical activity significantly contributes to active ageing by maintaining functional ability, enhancing psychological health, preventing and managing chronic diseases, premature death, illness and disability, and improving quality of life and independence [76]. Participation in regular, moderate physical activity can delay functional decline and delay the onset of chronic diseases in both healthy and chronically ill older people. For example, regular moderate physical activity reduces the risk of cardiac death by 20 to 25 percent among people with established heart disease. It can also substantially reduce the severity of disabilities associated with heart disease and other chronic illnesses [77]. Regular and adequate physical activity has been demonstrated to

improve physiological aspects such as maximal aerobic capacity [78], muscle strength [79], coordination and balance function [80] and walking speed [81]. It can also prevent diseases such as cardiovascular insufficiency [82], type 2 diabetes [83], osteoporosis [84] and cancer [85], as well as mental disturbances such as depression and even cognitive decline [86].

Active living improves mental health and often promotes social contacts. Being active can help older people remain as independent as possible for the longest period of time [87]. It can also reduce the risk of falls [88]. There are thus important economic benefits when older people are physically active. Medical costs are substantially lower for older people who are active [89]. Despite all of these benefits, high proportions of older people in most countries lead sedentary lives [90]. Physical inactivity is among the important risk factors for morbidity and mortality. The encouragement of a physically active life style has therefore been introduced as a feasible way to promote the psychological and physical health of the general public [91]. An individual's physical activity habits are shaped throughout life, and various factors, including socioeconomic and cultural determinants as well as environmental and social burdens, influence his/her habits in this respect [92]. Previous studies have confirmed that sedentary behavior is more common in old age than earlier in life [3-4]. Independence in activities of daily living (ADL) can also affect health [8] and may vary according to a person's socioeconomic status [93]. An old person who is independent in ADL may value her/his health status highly and try to improve it.

Building and testing various models to show the intermediating links to HS can help to discover the role of influencing factors [94-96]. Such models can illuminate the direction and degree of direct and indirect effects of health-related determinants [94,95]. During the last thirty years, methods and software have been used for structural equation modeling (SEM). SEM allows researchers in different fields to assess their theories empirically. These theories are usually formulated as theoretical models for observed and latent (unobservable) variables. If data are collected for the observed variables of the theoretical model, proper programs such as Mplus 5 can be used to test whether the model fits the data. Mplus can estimate both structural equation models and path models for a single group or multiple groups. In addition, it can estimate models with regressions among combinations of continuous latent variables and observed variables. In Mplus, both factor indicators and other observed dependent variables for these models can be continuous, censored, binary, ordered categorical (ordinal), counts, or combinations of these types of variables [97].

Physical activity patterns in older Iranians and their relation to functional performance has not been previously described. The opportunity to build on experiences from a Swedish study meant a possibility to carry out a similar Iranian study.

2 Aim and objectives

2.1 Overall aim

The overall aim of this thesis was to provide a perspective on the current situation regarding physical activity and functional performance in older Iranian people and to compare it with the situation among their Swedish peers in order to explore determinants for health status (HS) in different cultural contexts.

2.2 Specific objectives

- To translate the Swedish version of the FES, the FES(S), and to evaluate the validity and reliability of the translated version to ensure that it is culturally appropriate for Persian-speaking elderly people in Iran (Study I).

- To compare the physical activity level, physical functioning and certain health related factors in 75-year-old women and men in Sweden and Iran (Study II).

- To compare Iranian 75-year-olds who walked at least 30 min a day with others who walked less, from a gender perspective, regarding perceived health and fitness, physiological capacity and functional performance (Study III).

- To develop a confirmatory structural equation model to test the links between the concepts of socioeconomic status (SES), health-related behavior (HRB), independence (I) and health status (HS) in 75-year-olds in Iran (Study IV).

3 Material and methods

Study designs, populations and data collection procedures are summarized in Table 1.

Table 1. Study designs, populations and data collection procedures.

Study	Design and Method	Study Population	Data Collection
I Published	Methodological Cross-sectional	Eighty-one community-dwelling older Iranians (≥ 65 years)	Participants were invited by telephone and interviews were performed face to face in a hospital setting.
II Published	Two cross-sectional Comparative	A total number of 637 individuals in Gothenburg and 851 individuals in Tehran	The participants had a written invitation followed up with a telephone call in Sweden, but in Iran exclusively a telephone call. Interviews and objective tests of functional performance were carried out by a physiotherapist.
III Submitted	Cross-sectional	A total number of 851 individuals in Tehran	The participants were invited by telephone in Iran. Interviews and objective tests of functional performance were carried out by a physiotherapist.
IV Manuscript	Cross-sectional Structural modeling		

3.1 Participants

The thesis covered three samples: Eighty-one older persons ≥65 years in Study I, a total number of 637 75-year-olds in Gothenburg (Study II) and 851 75-year-olds in Tehran (Studies II, III and IV).

3.1.1 Study 1

A sample of 81 elderly people ≥65 years was randomly selected from community-living people in Tehran in the spring of 2007 and included considering a power of 90% and a confidence interval (CI) of 95%. Inclusion criteria were independence in indoor ambulation with or without assistive devices, Persian language as mother tongue and ability to understand its concepts [98]. Exclusion criteria were communication deficits, illiteracy and cognitive impairment according to a Mini-Mental State Examination score (MMSE) [99] below 18 [100].

3.1.2 Study II

Based on the procedure shown in Figure 4 a-b [101], a total of 637 persons in Gothenburg and 851 persons in Tehran were included in the present study.

Swedish cohort
As part of the longitudinal Gerontological and Geriatric Population Studies in Gothenburg, H70 [102], and also of the longitudinal Prospective Population Study of Women in Gothenburg initiated in 1971 [103], 75-year-olds born in 1930 and living in Gothenburg, Sweden in September 2005 were invited to have a health examination in the period 2005-2006. A representative sample was obtained from the Swedish Population Register, based on birth date, and included both persons living in private households and in institutions. Individuals not able to visit the research clinic did not do the tests of functional performance and were excluded from this study.

Iranian cohort
Considering a required power of 80% ($p \leq 0.05$) and a drop-out rate of 20%, a total of 1100 individuals were randomly selected as a representative cross-sectional sample of 75-year-olds born 1932-1933 and living in Tehran, Iran, 2007-2008. Unintentionally, the sample obtained for this study included people living in private households [101]. Exclusion criteria for the Swedish cohort were inability to visit the research clinic and diagnosed dementia according to DSM-IV-criteria, while those for the Iranian cohort were communication deficits (couldn't answer questions about current time and year, their age, address, date of birth, differentiate between their caregivers, state Iran leader's name and so on) and/or severe functional disability (bedridden; couldn't come to research centre due to their severe functional disability).

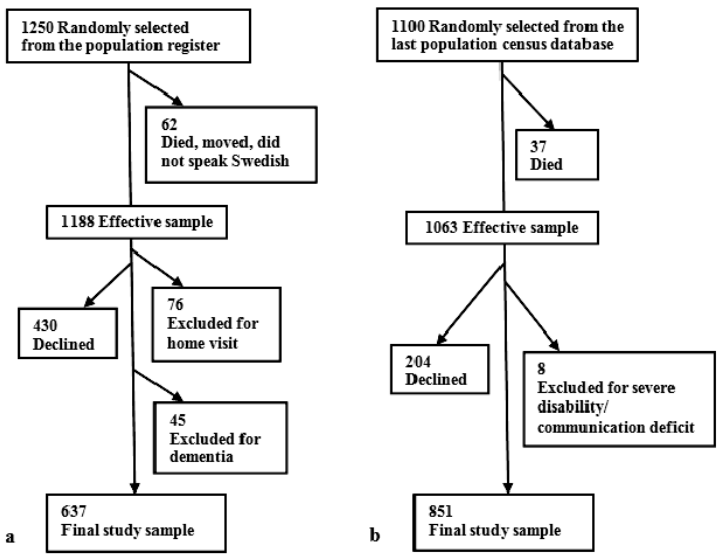

Figure 4 a-b. Flow charts indicating the recruitment procedure of the 75-year-old participants in Gothenburg (a) and Tehran (b). Mosallanezhad et al [101].

3.1.3 Studies III and IV

Studies III and IV included the Iranian cohort recruited for Study II (Figure 4b).

3.2 Ethics

The thesis and all related studies were approved by the Ethics Committees of the Ministry of Health, Treatment and Medical Education and University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. Informed consent was obtained from each participant before the time of administration. The Swedish part of study had received ethical approval from the Ethics Committee of the Faculty of Medicine at the University of Gothenburg based on the agreement of both countries. Informed consent was obtained from each participant before the time of administration.

3.3 Procedure and data collection

Instruments and questionnaires used in this thesis were the Persian version of the instruments that had been used in the Swedish study [102,103]. A standard method of forward/backward translation was used to provide the Persian versions; these procedures were the same as in Study I, which describes how the Persian version of FES(S) was produced [98]. Interviews and objective tests of functional capacity for the main study in Iran were carried out by an Iranian physiotherapist trained by the Swedish physiotherapist who was responsible for the H70 studies. Additionally, in Study IV some questions from a Persian study addressing aspects of physical and mental health as well as socio-economic status based on material from the municipality database were used.

3.3.1 Study I

FES(S) was translated into the Persian language and was then used in Study I. The translation followed a standard procedure [104, 105].

3.3.2 Study II

Interview

Background data including total years of education, job status, marital status, number of children and responsibility for taking care of others were collected. Smoking habits were described as non-smoker, former smoker or current smoker. Self-assessed medical conditions (such as heart, lung, musculo-skeletal and mental illness) were recorded, and participants were asked if they felt healthy (yes or no), if they felt generally tired (yes or no), if they had experienced a new illness or accident after age 70 (yes or no), if they were troubled by vertigo and/or impaired balance and if they felt unstable during walking (seldom or never; sometimes, moderate problems; often, severe problems). Disability was evaluated with a self-assessed level of dependence on another person according to a cumulative scale of five defined personal activities of daily living, (P-ADL) and four defined instrumental activities of daily living, (I-ADL) [106]. Participants were categorized as dependent if dependent in ≥ 1 activity.

Fall-related self-efficacy was evaluated by means of the Falls Efficacy Scale (FES) [98, 107,108] , and data were collected on the occurrence of falls during the past year.

Self-rated physical fitness was estimated with response alternatives: very poor, poor, quite good, good or very good [109]. Level of physical activity was estimated for summer and winter seasons according to a six-level scale, including household activities, ranging from hardly any physical activity to hard exercise several times/week. A high level means being more physically active [110]. The number of physical activities and/or sports during the past year was recorded [109]. Walking habits were described as the general weekly frequency and duration of walks [109].

Tests of functional performance
Walking speed was measured from a standing position for 20m in Sweden and 30m in Iran indoors at both self-selected and maximum speeds [109].
The ability to rise from a chair, 45 cm high, without support of hands was tested. Participants were asked to perform the test as fast as possible, five times in a row [111].
The ability to climb onto boxes of varying heights (10, 20, 30, 40 and 50 cm) without using a handrail was tested [110], and ability to manage ≥ 40 cm was used for analyses.
Balance was tested as one leg stance (right as well as left) without shoes, hands behind the back and looking straight ahead, for a maximum of 30 seconds. The test was interrupted if the participant moved from the standardized position. Three trials were allowed for each leg and the best value was used for analyses [112].
Body height and weight were measured with calibrated tools.
Grip strength was tested with a JAMAR® Hand Dynamometer 5031JI. The dynamometers were calibrated and showed no change in the calibrating factor during the test periods. The test was repeated three times for each hand, and the highest value for the best hand was used for analyses [113].

3.3.3 Studies III and IV

Apart from the instruments described above, some questions from a Persian study addressing aspects of physical and mental health as well as socio-economic status based on material from the municipality database were added. For Study IV a set of observed variables was classified for each latent variable reflecting the concepts of HS, SES, HRB and I.

Indicators of health status (HS)
Participants indicated if they felt healthy (yes or no), generally tired (yes or no) and rated their physical fitness as being either very poor, poor, quite good, good or very good [98,101].

Indicators of socioeconomic status (SES)
Socioeconomic indicators included overall years of education, job status: no formal job, being a worker (factory worker or laborer), voluntary work, official jobs (municipal or state employees), high ranked jobs (such as university professor or physician) and monthly family income, where the last two variables were from the Persian database [114].

Indicators of health-related behaviors (HRB)
Indicators of HRB included physical activity level in the summer and winter seasons according to a six-level scale, including household activities, ranging from hardly any

physical activity to hard exercise several times/week. A high level means being more physically active, and the scale has been shown to be valid [110,115].

Indicators of independence (I)
Using the ADL staircase [98,112], participants rated their level of dependence on another person and their feeling of un-safety when doing five defined personal activities of daily living (P-ADL) and four defined instrumental activities of daily living (I-ADL). Cumulative scales, as number of dependent/un-safe activities, were used in the data analysis, where high scores mean dependent/un-safe in more activities. Answers to questions regarding independence in usual tasks indoors obtained from the Persian database [114] were also included.

3.4 Data analysis

The Statistical Package for the Social Sciences (SPSS) 16.0 program was used for data analyses (SPSS, Chicago, IL). A p-value of ≤0.05 was considered significant. The 95% CI were used to describe significance and size of differences for continuous data. All significance tests were two-tailed.

3.4.1 Study I

Cronbach's Alpha coefficients were used to evaluate the degree of internal consistency of the scale's items of the Persian FES(S) used on the first occasion (here called FESa). To evaluate test-retest reliability, the participants were asked to rate their perceived confidence once more based on the scale after four weeks [105], (called FESb). Interclass Correlation Coefficients (ICCs) and standard Errors of Measurements (SEM) were computed to assess relative and absolute reliabilities, respectively. To evaluate construct validity, correlations between the total scores of the Persian FES(S) and the mentioned demographic and health-related outcomes, as the theoretically-related variables, were measured. In order to compare score means of the Persian FES(S) between groups, independent-t tests were implemented. Finally, correlation analyses were used to determine the association between the Persian FES(S) scores and other outcomes. Pearson correlation coefficients were computed for interval outcomes and Spearman correlation coefficients for ordinal outcomes. The level of significance (two-tailed) was set at .05 for all tests.

3.4.2 Study II

Parametric and nonparametric tests were used for group comparison between the two countries. Fisher's exact test (for dichotomous nominal data), the Cochran-Armitage test (for trend for ordinal data) Student's independent samples t-test (for continuous data) were used. For the Falls-efficacy scale and one leg stance test, the median was compared between groups, and confidence intervals for the median and the difference between medians were calculated by the percentile bootstrap method. Gender differences in the two countries were measured by odds ratio (OR) with 95% confidence intervals from separate logistic regression models, and to test the hypotheses of equal gender difference in both countries, a total model including the interaction term gender by country was used. The choice of the odds ratio as a measure of gender difference was based on the desirability of using the same type of model and

test for all comparisons, both for difference and interaction and for characteristics / performance measurements in dichotomous, ordered and linear scales.

3.4.3 Study III

The two variables of walking days per week and walking duration were combined into a dichotomous variable defining a group walking at least 30 minutes daily/almost daily (Walkers) and a group walking less than 30 minutes daily/almost daily (Non-Walkers). The options of the variable self-rated physical fitness were combined to make three levels (Very poor / Poor, Quite good, Good / Very good), the physical activity scale options were similarly reduced to four levels (1-2, 3, 4, 5-6) and the two ADL subscales to three levels (0, 1-4, 5-9 activities). Regarding the maximal isometric strength of the quadriceps, the results differed greatly between men and women. As a consequence, the strength values were standardized separately for men and women, and new variables with the same mean and standard deviation for men and women were created, after which the maximal torque by the best leg was used in the model. Logistic binary regression models were used to measure the strength of association between the outcome variables and walking habits (odds ratio (OR), for being in the group of Walkers), separately for women and men, and combined. The combined model was also used to test gender interaction, i.e. if the strength of association between walking group and other factors was different for men and women. Limit of significance of association and interaction was set to 5%, and 95% confidence intervals (CI) are reported.

3.4.4 Study IV

A hypothesized model including the concepts (as latent variables) and indicators (as the observable variables) was designed. Mplus 5 was used to test the structural equation model of our hypotheses [97]. In the first step, testing the measurement model involved relating the observed variables to the underlying concepts by means of confirmatory factor analysis. In the second step, the conceptual model was tested to evaluate the hypothesized links between the latent variables (HS, SES, HRB and I). In both steps, we used the maximum-likelihood estimation with robust standard errors (MLR estimator), which can effectively deal with the data that are not normally distributed. To test the goodness of fit to the model, Chi-square test and some additional statistics, e.g. the root mean square residuals and the adjusted goodness of fit were applied [116,117]. Therefore, besides the goodness of fit index (and degrees of freedom), we used the Comparative Fit Index; CFI), and the Root Mean Square Error of Approximation (RSMEA) to evaluate model fit. The CFI [118] can vary between 0 and 1 (higher values indicate better model fit) and measures how well the model fits relative to a baseline model [25]. As a common rule of thumb, values greater than .95 indicate a good fit to the data, and values greater than .90 indicate an acceptable fit [119]. The RMSEA [120] measures the amount of discrepancy between a specified model and the collected data. It has been suggested that a value of .05 and below indicates a good fit to the data, a value of about .08 and less indicates an acceptable fit, and that values greater than .10 should not be accepted [120].

4 Results

4.1 Study I

4.1.1 Validity of the Persian FES (S)

The internal consistency of the Persian FES(S) used on the first occasion (here called FESa) was assessed. To evaluate test-retest reliability, the participants were asked to rate their perceived confidence once more based on the scale after four weeks [118], (called FESb). Mean (SD) scores of the FESa and FESb were 120.88 (16.43) and 120.23 (16.59), respectively. The maximum scores obtained from the FESa and FESb were rated by 27 (33%) (skewness = -2.580) and 33 (40.7) (skewness = - 2.579) of the participants, respectively (Figure 5). The results indicate low to moderate negative correlations between the total score of FESa and the age of the participants and number of falls in the past year, and low to moderate positive correlations between FESa and the MMSE score, duration of walks and self-rated physical fitness. Regarding the dichotomous variables, the scores obtained for FESa were not significantly different in terms of gender. A significantly higher fall-related self-efficacy was shown in the participants who reported daily walk, feeling healthy, no feeling of general tiredness and no fall in the past year (Figure 5).

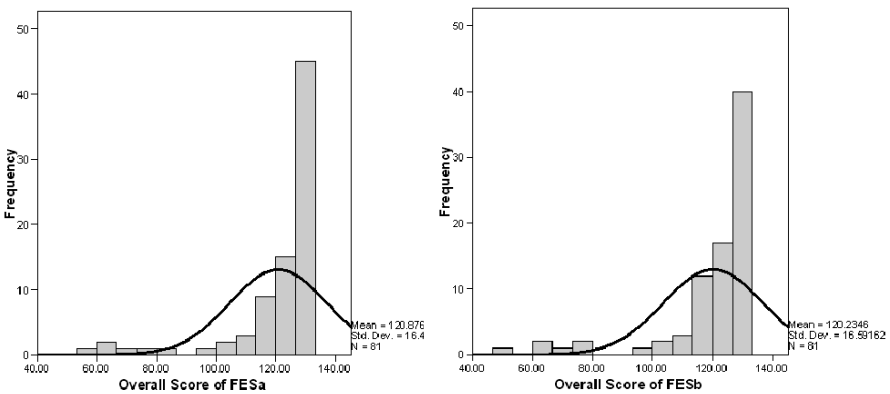

Figure 5. The histograms showing the distribution of the scores obtained from FESa and FESb. Source: Mosallanezhad Z et al 2011 [98].

4.1.2 Reliability

Cronbach's Alpha for the total score of the Persian FES(S) obtained from the first occasion was 0.75. ICC between FESa and FESb was 0.99 ($p<.001$) and SEM was 1.82, confirming the relative and the absolute reliabilities of the scale. Figure 8 shows the distribution of the overall scores of FES on the two test occasions (Figure 6).

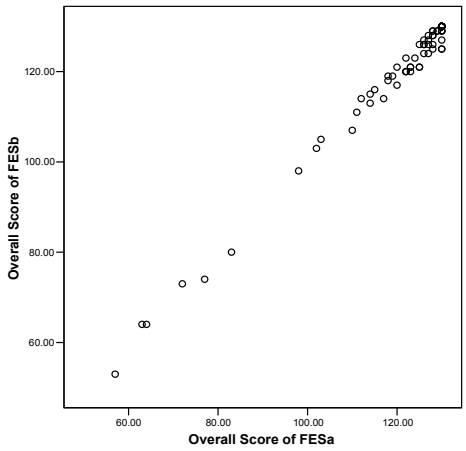

Figure 6. Scatter plot of the Persian FES(S) applied on the test (FESa) and retest (FESb) occasions. Source: Mosallanezhad Z et al 2011 [98].

4.2 Study II

4.2.1 Background data

Compared to their Swedish counterparts, Iranian 75-year-olds had a lower level of education, were more likely to never have had a job, were more often married, had a higher number of children, were more often taking care of a family member, were less often current or former smokers, were shorter, and weighed less. When men and women were analysed separately, there were differences in all variables except job status and smoking habits in men and marital status in women.

4.2.2 Health, physical activity and physical performance

Iranians had a medical condition more frequently than Swedes, fewer Iranian participants felt healthy and a greater number felt tired. Regarding new illness or accident after age 70, vertigo/impaired balance and feeling of instability during walking, there was no difference between the two countries. Iranians were more often dependent in ADL and had a lower median score in FES, but there were no differences in the occurrence of falls during the past year. Iranians had a lower degree of good or very good self-assessed physical fitness, a lower physical activity level, a lower number of physical activities in the past year and less often took a daily walk of ≥30 minutes (Study II: Table 2).

Iranians also had worse results for maximum walking speed, self-selected walking speed, timed chair stand, stair-climbing capacity ≥ 40cm and one leg stance.
In the tests of grip strength, Iranians had better results (Study II: Table 2).

The extent of the gender differences in the two cohorts was similar in most aspects, although there were larger differences in Iran in walking habits, self-selected walking speed, timed chair stand and one-leg stance, and in Sweden in grip strength, all to the disadvantage of women. However, the gender differences regarding the physical

activity level showed an opposite pattern, as Iranian women scored higher than men while Swedish women scored lower than men.

4.3 Study III

4.3.1 Outcome in Walkers versus Non-Walkers

Regarding walking habits, 249 (29.3%) of the participants were classified as Walkers (W), 85 (21.5%) of the women and 164 (36%) of the men. Of the 602 Non-Walkers (NW), 310 (51.5%) were women and 292 (48.5%) were men. The participants' physical activity level was higher in the summer season; 65.3% (68% of the women and 62.3% of the men) rated their level as 3 or 4 in summer compared to the winter season, when the proportion was 58.3% (61.3% of the women and 55.7% of the men). The vast majority of the participants (94.7% of the women and 77.4% of the men and) had never smoked.

Better results for Walkers in both women and men were observed in most subjective and objective outcome measures. Focusing on subjective health-related outcomes, Walkers were less likely to feel generally tired, more likely to have better physical fitness and to have the maximum score on the Falls Efficacy Scale, less likely to feel unstable during walking outdoors and less likely to be dependent or unsafe in ADL. Walkers of both genders performed better in the chair stand, one leg stance, maximal walking speed and six min walking tests. In general, the difference between Walkers and Non-Walkers was greater in men (Tables 1 and 2, Study III).

Almost all variables were in favour of Walkers, with larger differences among men. The gender interaction had a significant effect only on the results related to feeling healthy and self-rated physical fitness (Table 3, Study III).

4.4 Study IV

4.4.1 Participants

Of the total study population, 51.6% reported feeling healthy. Overall years of education and monthly family income were significantly higher for men than for women ($p<.05$). About half of the participants were women; 86.1% of them were housewives. Of the men, 46.5% had voluntary work, 36% official jobs, 10.7% were workers and 5.3% had a high-ranking job. The most frequent physical activity level was 3 for both summer and winter seasons (more than 40%), and half of the participants rated their physical fitness as quite good. Results of the cumulative scales regarding the ADL staircase showed that 45% of the participants were independent and 48.8% felt safe when doing ADL. In response to the question regarding independence in usual tasks indoors, 56.6% answered yes. Bivariate correlations and mean values of the study variables are shown in Study IV: Table 1. Men showed better results than women regarding the indicators of HRB and I ($p<.05$).

4.4.2 Measurement models

To verify if HS, SES, HRB and I can be preserved as separate latent constructs, a measurement model was tested (Figure 7). The model also included two-way paths between the concurrent latent constructs. This model yielded a reasonable fit to the data, $\chi 2 = 110.93$, df = 38; CFI = .97; RMSEA = .047, with 90% C.I. = .037 - .058.

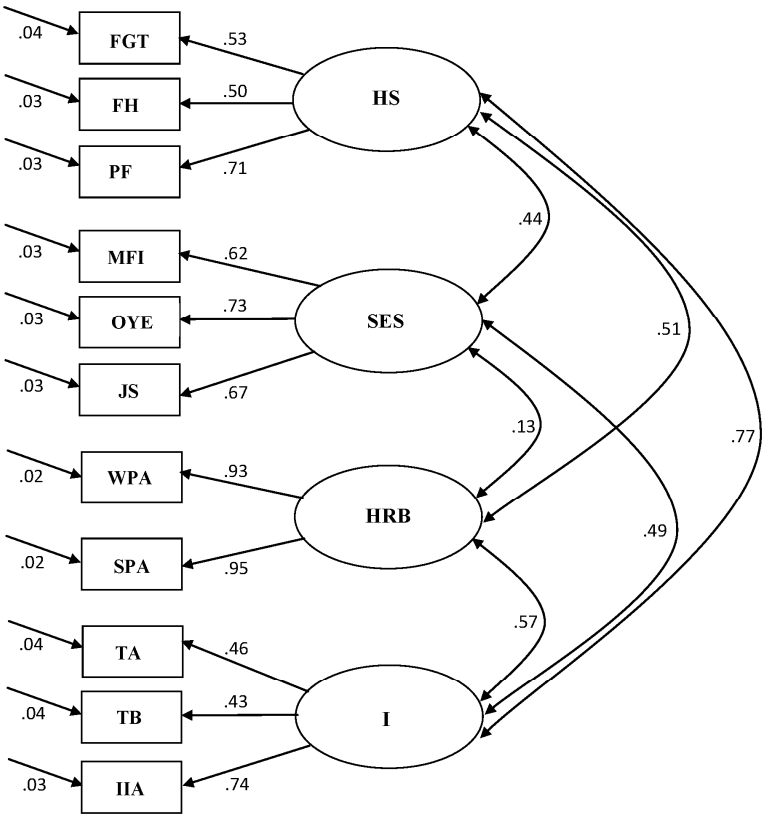

Figure 7. Measurement Model confirms relations between observable variables with latent variables. Factor loadings for HS were .44 for SES, . 51 for HRB and .77 for I. P-values for estimates of relations between each latent variable with its related observable variables were equal to zero.

***HS**: Health status; FGT: Feeling of Generally Tiredness FH: Feeling healthy, PF: Physical Fitness*
***SES**: Socio Economic Status; MFI: Monthly Family Income, OYE: Overall years of education, JC: Job status*
***HRB**: Health Related Behavior; SPA: Summer Physical Activity level, WPA: Winter Physical Activity Level*
***I**: Independence; TA: Total A: ADL Staircase, dependence (Total score of 0: completely independent), TB: Total B: ADL Staircase, security (Total score of 0: completely safe), IIA:Independence in indoor activities*

4.4.3 Conceptual model

A proposed structural equation model was designed. It reflected the impact of SES diversity on the health status of older persons, relations between the determinants of each variable, as well as the probable links between independent and dependent variables (Figures 7 and 8).

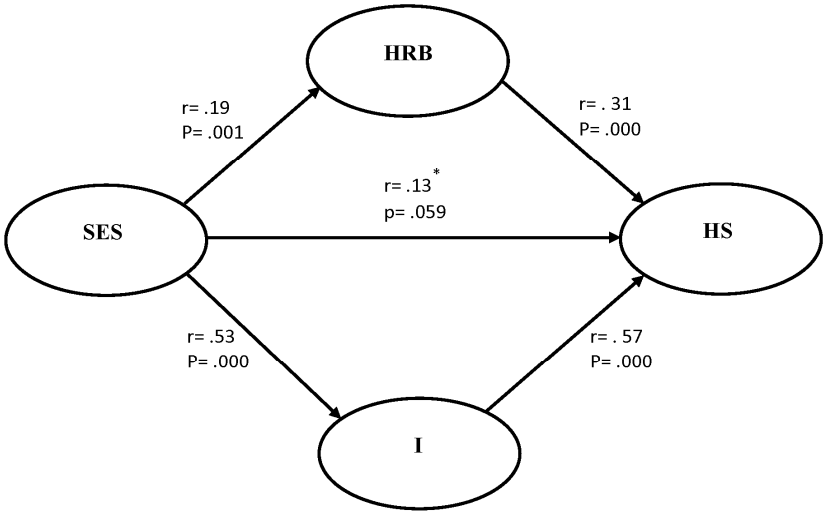

Figure 8. Conceptual model for the whole population (a), shows relations between socio-economic status (SES) and health status (HS) and intermediating role of the health-related behaviors (HRB) and independence (I).

The cross-sectional inter-correlations between SES, HRB, I and HS were tested. The estimation of this hypothesized structural model yielded an acceptable fit to the data, $\chi 2$ = 271.64, df = 39; CFI = .91; RMSEA = .084, with 90% C.I. = .074 - .093. The conceptual links are displayed in Fig. 3. As the figure shows, SES itself was not a direct predictor of HS (β = .13, p= .059), but it was predictor of HS either through affecting HRB (β = .31, p=.000) or I (β = .57, p= .000). And both these factors could influence HS positively.

5 Discussion

5.1 Physical activity physical function and health

Among the most hazardous injuries in old age, which may lead to functional decline, less social participation and the opposite to active ageing, is falling and its consequences [55,57-59, 121]. Even more disabling are the fear of falling and loss of self-efficacy [57-58]. The first study of this thesis confirms that the Persian version of FES (S) is a culturally appropriate and adaptable instrument, and the standard procedure used to provide the Persian version allows the results to be compared with similar studies worldwide. Like the main version and some of its modified versions, the Persian FES (S) showed a ceiling effect. The FES International (FES-I), a newly developed 16-item scale, covers more demanding physical and social activities [62-64,66, 122], making it a more useful instrument for elderly people with limited activity restriction and for evaluating the effectiveness of prevention programs [66].

Both subjective and objective findings from Study II indicated that the Swedish cohort had better results than the Iranian cohort regarding physical activity level, physical performance and many socio-demographic aspects. The exceptions were no differences between the cohorts regarding vertigo or falls, and better grip strength and smoking habits in the Iranian cohort. The gender differences in the two countries were similar in extent and in favour of men regarding most aspects. However larger gender differences were seen regarding some lower extremity functions in Iran and in the physical activity level in Sweden.

These findings are supported by the studies showing that people are healthier in more developed industrialized countries [123,124]. One possible explanation for better results in physical functioning in the Swedish cohort might be the large difference in physical activity patterns to the disadvantage of the Iranian cohort. The prevalence of regular walkers in Iran was lower than in the Swedish cohort, but comparable to that of older adults in the United States [125]. Interestingly, there was no difference regarding the frequency of falls between the countries, despite worse results in lower extremity strength and fall-related self-efficacy in Iranians. This might be due to their lower level of physical activity, which could mean less exposure to risks. Grip strength is a commonly used measure of physical activity level and physical functioning in older adults and is often parallel to the lower extremity capacity and overall muscle force [126]. A reason for contradictory results in Study II might be that this variable is supposed to be more influenced by body composition, life style and occupational demands than by ethnicity [127]. Industrialization, an increase in technical efficiency and the use of more instruments in activities of daily life can lower muscle strength and skills [123]

Iranian 75-year-olds also showed a higher level of dependency in ADL than Swedes. This might be due partly to a lower level of physical activity and partly to the cultural and religious background in Iran, which encourages younger people to take care of their elderly parents. The supportive and care-giving attitude toward elderly Iranian women in particular may, despite the advantage, contribute to dependence in functioning and a lower physical activity level, especially regarding outdoor

activities. In developed countries like Sweden, older people may value their independence and prefer to live alone. A recent study of older people in Teheran, Iran, showed better results in mental than physical health-related quality of life [128]. This might be attributed to a lifestyle with a larger social network [129], also seen in this study, or the socio-cultural position of older people in Iran and the community organization. The present thesis did not focus on these aspects; however, these could be of relevance for future studies.

In line with Study II, Study III confirmed that Iranian 75-year-olds with good walking habits showed better results regarding functional performance. The pivotal dimension of successful ageing is active ageing [130,131]. Walking is a simple and easy form of exercise, which can promote activity, functioning and social participation. It needs no special equipment, and most people can perform it as part of their daily routine and in their neighborhood. A program with gradual progression to daily brisk walking for a minimum of 30 minutes is adequate to produce major benefits. The key is to be physically active on a regular basis [16,132]. However, establishing the habit in middle age can postpone the age-related changes that start as early as the third decade of life [133]. Even at a level below that currently recommended, exercise was shown to reap benefits [11,134]. Future investigations may reveal the minimum degree of exercise needed, as many people fail to achieve the currently recommended target for exercise due to lack of time [135]. Small differences between female Walkers and Non-Walkers in variables such as self-reported health and physical performance measures may possibly be explained by psycho-social factors that may affect self-estimations of health status and functioning [136]. Future studies are required to elucidate the mechanisms that explain gender-specific discrepancies in health and physiological capacities. Our findings were also in line with studies showing that women had a lower physical activity level than men [137-140], a greater use of medication and care services [141] and also a lower socioeconomic status [92].

Study IV presented a fit conceptual model on the relation between SES and HS. SES was not a direct predictor of HS, but a high SES could support the possibility of high physical activity level and independence, and these factors could improve heath. This structural model included some socioeconomic, behavioral and self-confidence aspects. Many other aspects, including genetics, nutrition, sleeping habits, emotional and spiritual aspects, culture, environmental factors and access to health services, can affect the links to HS [73,75,91,92,94]. More extensive structural models could be useful for exploring the intermediating links between SES and HS. The relation between higher SES and better HS may be explained by differences in access to medical care, health-related behavior, psychosocial stress and the fact that persons with a low SES are more exposed to life stressors [94,95]. Weaker psychological coping strategies, more hostility and less perceived control [94,95,142] have also been highlighted. Cultural, social and economic reserves as well as people's perceptions and knowledge about a healthy lifestyle determine both their behavioral options and preferences and health-related values and norms [69]. It can therefore throw light on the related process leading to inequalities in health.

The findings regarding health determinants and health-related risk factors among people in different socioeconomic positions are conflicting. They ranged from a

strong negative link between SES and health-related risk factors [143-145], no difference [93,95], and a positive link [146]. This discrepancy may be related to the different approaches of the studies, including design, methodology and sample size, or intraindividual, cultural and environmental differences [93,144]. However, both Study II and Study III emphasize the role of physical activity and independence as the predictors of health. According to both longitudinal and cross-sectional studies, the absence of health-risk behaviors such as physical inactivity can postpone and reduce the risk of disability, morbidity and, consequently, increase QOL and wellbeing in old age [14, 147-149]. In neighborhoods inhabited by people with a poor education and low income, limited access to facilities for different types of exercise is common. These limitations can lead to stressful conditions and little time for exercise, resulting in a tendency toward a low level of physical activity [73,75,145,150]. In contrast, neighborhoods with a nicely planned environment and accessibility to parks, gyms and other facilities for exercise have a positive influence on health [73, 75,149]. In addition to material factors, non-material resources can also encourage healthy lifestyle patterns [69]. The perception and knowledge of health-related factors and social norms supporting physical activity and access to physical activity resources vary in different SES neighborhoods [142,149-152]. Even a tendency among physically active people to migrate into supportive environments has been shown [149]. The association between decline in global ADL and independence of elderly people has been documented [93]. Our studies confirm earlier findings that there is a relation between confidence in ADL and better health in old adults [93].

Future research is needed to illuminate the factors which mainly contribute to the physical inactivity in older Iranian women in particular. Younger Iranians nowadays are more used to participating in exercise programs in gyms and parks as well as in group sport trips such as mountain climbing, skiing and competition sports, so the situation might change over time. However, efforts are needed to convince older people as well of the benefits of physical activity and to stimulate them to find an activity that they enjoy. A higher life expectancy in women and the two concepts of "feminization of the world" and "the gender paradox" refer to the higher proportion of elderly women with a high morbidity (but low mortality) worldwide [31,151]. It emphasizes the need for studies that explore intrinsic and extrinsic factors influencing health and function, which can facilitate the planning for proper interventions to reduce disability especially among women. A person's beliefs and behavior regarding a physically active and healthy lifestyle can be influenced by factors such as motivation and time, socio-cultural circumstances like support by family and friends, and also by the socio-economic characteristics of the area in which they live, including access to convenient facilities and safe environments in which to be active [140,152,153]. The accessibility and proximity of such facilities, especially for women in Iran, should be objectively assessed in future studies. People who believe that their environment is suitable for physical exercise are more likely to perceive their health as good [154]. Barriers can cause avoidance of activity and, consequently, a decline in health and functioning. The maintenance of health and functioning in old age is also explained by the interaction of the structural characteristics, physical activity habits and environmental factors [155].

5.2 Metodological considerations, limitations and suggestions

The high internal consistency of the Persian FES (S) confirms the homogeneity of its items in measuring different aspects of its construct [104]. When evaluating the validity of the Persian FES (S), we considered using both participants' viewpoints and experts' opinions. Other studies on validation, for instance, the Chinese Translated Activities-Specific Balance Confidence Scale [155] and the French-Canadian Questionnaire for Pruritus Assessment for burn survivors [156], have confirmed that this approach is easy, straight, and useful. With one month interval between the first and second test occasions, ICC=0.99 was obtained, which can be considered a reinforcing point. ICC values of 0.75 and above are indicative of good reliability, while those between 90 and 99% are considered excellent when evaluating the relative reliability of the scales [157]. The SEM was small enough, indicating that the variability that can be attributed to measurement error was acceptable in the present study [158]. In line with a study which used FES(S) to evaluate fall-related self-efficacy in stroke patients [65], the participants in the present study tended to report lower self-efficacy in I-ADL. For community-living elderly populations, FES-I could be an alternative, but this instrument was not available at the start of the present study. A validated Persian version of that scale as well would be useful for future international comparative studies. As our study sample included persons without cognitive impairment, the generalizability of the results to those with MMSE <18 and illiterate old people could be doubtful. Using other scales to evaluate cognitive impairments, which are even applicable for illiterate people such as HMSE can be an alternative to consider.. HMSE is a Hindi adaptation of the MMSE in which tests that require reading and writing have been modified to make the test appropriate for assessing the cognitive functioning of illiterate persons [159]. Overall, low to moderate correlations were found between the score of the Persian FES(S) and the other assessments included. As these assessments focus on different dimensions of health and activity habits, such an outcome could be expected. It can justify the use of the Persian FES(S) also in this group of elderly people, as it measures fall-related efficacy, a unique factor with an impact on health.

Cross-national and cross-cultural comparisons are desirable, but meaningful only if based on comparable methodology [33]. Study II focused on multidimensional features of physical activity level, physical performance and health related factors in older adults in two countries, measured with similar methods. Using both self-report and ‘‘objective’’ measures may be the only way to achieve optimal findings [160]. Extensive similar health-related measures, such as those used in the present study, are quite rare. One of the main strengths of the comparison study is the use of standard procedures to translate the questionnaires and test procedures, to minimize methodological differences related to definitions and wording of questions. Despite this, regarding questions about health and ADL, it is hard to know how much cultural influence there is in the interpretation of the questions and the response alternatives [37].

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As the life expectancy in Iran is lower than in Sweden, health status and functioning in chronologically 75 year-old Iranians could be comparable with chronologically older Swedish persons. Worse results in the Iranian cohort could be a result of biological age, measured as ‘‘time to death’’, which has been shown to be a better predictor than

chronological age regarding cognitive health [161]. Unfortunately, the test of walking speed differed in the two countries, as the Swedish cohort walked 20 m instead of 30 m, which might be a reason for the lower velocity in the Iranian cohort. However, the general homogeneity of results in self-report and objective physical functioning supports good validity. The sample selection differed somewhat in the two countries since their community organizations differ, but in both cohorts participants had to be able to visit the research clinic to be included in this study.

A further strength of the present thesis is the inclusion of large, representative samples of community-dwelling old people. There are, however, some limitations regarding the methodology. While the homogeneity of this population with regard to age may limit the generalizability of study findings to other age groups of old individuals, it can serve as a built-in control that strengthened our ability to draw inferences and omit the effect of age-related confounders. A comment should be made on the proportion of 75-year-old women in the present study. Due to the improvement in life expectancy for women, the latest Iranian census records at the time of study showed that the proportion of 75- year-old women exceeded that of men [22], in contrast to the proportion of women to men included in the present study. This can be explained partly by the random procedure used for sample selection and partly by the higher proportion of women who declined to participate in our study.

Studies have shown that women and men use different criteria to judge self-rated health. Greater stoicism among men and a greater willingness among women to report health problems [162] might have influenced our findings regarding the subjective reports, something that affects all studies with a similar focus. However, our study could provide similar subjective and objective evidence of the benefits of good walking habits. As our study design was cross-sectional, casual relationships must be interpreted with caution.

Various studies have emphasized the use of structural equation modeling to determine the direction and significance of the links between different constructs including socioeconomic and health discrepancies [74,94,163]. However, the models that were designed and tested in the present thesis indicate a linear equation relationship between the variables, which is a limitation. A more extensive linear or a non-linear model including most influencing factors could result in a fit model with more acceptable predictability. Since the present model does not address the possibility of non-linear relationships, further research is needed to establish the existence of such relationships, including age [39], psychological and cultural [142,143,164], as well as environmental, lifestyle and other health-influencing determinants [4,33]. A multivariate model that includes all these aspects would be a helpful tool for gaining a better understanding of the role of each factor in the multifaceted pathways linking unequal socioeconomic positions to inequalities in health [164]. In general, path diagrams including Mplus play a fundamental role in structural modeling, and the causal relationship between independent and dependent variables shows that they are interconnected. Longitudinal studies would be more appropriate for establishing casual relationships [95,142].

Study IV focused on self-rated data, and self-rated health is assumed to be a reliable tool for assessing health status. It can also be a good predictor of functional ability in

old people [72,163]. The use of self-reported data for behavioral indicators could be considered a limitation. Some studies indicated that individuals might over-report their physical activity level [75,142,146]. However, Study II has confirmed the homogeneity of the results related to both subjective and objective variables [101]. Monthly family income was also self-reported. Many of the participants tended to report its approximate value. In addition, as a historical tradition in the world and a common cultural trend especially in the old population in Iran, the husband is responsible for providing financial support to his wife and children and takes care of most outdoor affairs including shopping. The woman is mostly responsible for household activities and for taking care of the children. Usually the man allocates money and necessities to his wife and children based on the amount of his earnings and their needs, something that may have affected the participants' description of monthly income. A future study is needed to run and test separate structural models for women and men to better understand related pathways.

5.3 Policy action for active ageing

Based on the United Nations Principles for Older People including independence, participation, care, self-fulfillment and dignity, a policy framework for active ageing has been developed [16]. This framework emphasizes action in three pivotal aspects. The first is health, which points to reducing the risk factors (both environmental and behavioral) for chronic diseases and functional decline to improve both quantity and QOL. The second is participation, which emphasizes full participation in socioeconomic, cultural and spiritual activities. According to the basic human rights, capacities, needs and preferences, people will continue to make a productive contribution to society in both paid and unpaid activities as they age. And the third pivotal aspect is security, which refers to policies and programs addressing the social, financial and physical security needs and rights of people as they age.

All other sectors of society should cooperate with the health and social services (including education, employment and finance, social security, housing, transportation, etc) and coordinate their efforts to fulfill active ageing requirements with emphasis on intergenerational relationships and reduce inequities among older people, especially those with a lower SES. An active ageing approach seeks to eliminate age discrimination and recognize the diversity of older populations [2,9]. Older people should actively participate in programming action plans and strategies toward active ageing. WHO offers a framework for action for policy-makers, and together with the newly-adopted UN Plan of Action on Ageing, it highlights multi-sectorial policies which will enhance health and participation among ageing populations while ensuring that older people have adequate security, protection and care when they require assistance. The active ageing approach provides a framework for the development of global, national and local strategies on population ageing. By pulling together the three pillars for action of health, participation and security, it offers a platform for consensus building that addresses the concerns of multiple sectors and all regions. Policy proposals and recommendations are of little use unless follow-up actions are put in place. The time to act is now. Income, work and social protection for older people also need particular attention. Old people are not homogeneous, but most of them are vulnerable with regard to rising public expenditures for medical care. Old age itself is

not associated with increased medical spending. Rather, it is disability and poor health – often associated with old age – that is costly. If people age in better health, medical spending may not increase as rapidly. Policymakers need to look at the full picture and consider the savings achieved by reducing disability rates, chronic disease and functional impairments [126,147,165,166]. Establishing appropriate prevention programs will increase the number of healthy older people who can participate in society and even in the work force (through either full or part-time employment) and consequently their contribution to public revenues would increase continuously. It is often less costly to prevent disease and disability than to treat them, and research has shown that physical activity can lead to saving $330 in annual direct medical costs of an employee [166,167] and also a program of 20 minutes of brisk physical activity twice per week can save companies $500 in health care costs per participating employee [168].

6 Conclusions

- The Persian version of FES(S) was shown to be a valid and reliable tool.

- 75-year-old Iranians were less physically active than their Swedish peers and their functional performance, apart from grip strength, was worse, while similar gender differences were found, mainly to the advantage of men.

- Iranians who took a daily walk of at least 30 min a day showed better results in most health-related outcomes, ADL and functional performance than persons who walked less.

- Physical activity level and independence were more important predictors of health than socio-economic status.

- A close international collaboration among researchers and health and social authorities, as conducted in this thesis, can enable comparative studies of the type described and generate appropriate cross-cultural tools for improving health and quality of life in old age.

- As physical activity is a strong determinant of functional performance and health, activities like taking a daily walk of at least 30 minutes should be promoted.

- Gender-specific discrepancies found in relation to physical activity and performance call for longitudinal studies to establish the causes.

7 Possible implications for health care, community and future research

- The Persian version of FES (S) could be applied in research and/or clinical settings to predict and evaluate the self-efficacy and confidence of older Persian individuals and to determine the effectiveness of related intervention programs.

- Since population ageing is a highly complex and contextually based phenomenon, this international comparative study would be useful for identifying the specific areas that each country (Iran and Sweden) could improve. It could also be important in order to identify the modifiable and culturally appropriate determinants of health and functioning.

- Health policies should be directed towards providing a safe environment and appropriate socioeconomic and cultural circumstances to support a physically active life style, especially for older women in Iran. Regular physical activity is a cost-effective, easy and helpful way to promote health as well as being effective in the prevention and secondary and tertiary treatment of many chronic diseases. Resources should be targeted toward promoting physical functional performance in later life. A good social network can support walking habits as a practical, easy and achievable form of physical activity.

- Public policy and health policy need to work together to inform one another, and be directed toward countering the life circumstances and behaviors that generate poor health and promoting those that give rise to good health. They should also remove barriers to increasing healthy, social and physical behaviors.

- Longer life expectancy of women has led people to refer to the ‘‘feminization of old age’’ or ‘‘the world of widows’’. As this study has revealed gender differences to the disadvantage of women in health and functioning in both countries, it is crucial to emphasize proper policy and intervention programs for this group, especially in Iran where the gender differences were larger.

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