

# Research Paper: The Relationship between Demographic, Health, Physical Fitness and Socioeconomic Determinants and Functional Performance of Elderly People



Mohamad Rostami<sup>1</sup>, Zahra Mosallanezhad<sup>1\*</sup>, Afsun Nodehi Moghadam<sup>1</sup>, Enayat Allah Bakhshi<sup>2</sup>, Shapoor Jaberzadeh<sup>3</sup>

1. Department of Physical Therapy, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.

2. Department of Biostatistics, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.

5. Department of Physiotherapy, Faculty of Medicine, Nursing and Health Sciences, Monash University, Australia.

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## ABSTRACT

**Purpose:** Increased life expectancy leads to an increase in the elderly population. However, with an increase in the age, the number of chronic diseases and cognitive disorders also increases. Since the social, cultural, environmental, lifestyle and health-related behavior is specific to each nation, the present study aimed at investigating the relationship between socio-economic status, health, physical fitness, and cognitive function in older adults with functional performance in Iran.

**Methods:** It is a cross-sectional study involving 42 older adults (20 women, 22 men) through a survey questionnaire and accessible sampling method. The age range of the study participants was 60 to 91 years. The questionnaire was used by the examiner to collect information on the age, height and weight, history of diseases, health status, physical fitness, and socio-economic status, for assessing the functional performance of older adults. The three performed tests included Sit-to-Stand test to examine the strength and lower extremity function, the Timed Up and Go (TUG) test to measure the speed and balance while walking and the Purdue Pegboard Test (PPT) for measuring the hand function. A step-wise regression model analysis was applied by using SPSS (version 19).

**Results:** In sit-to-stand test, the test of significance of regression coefficients was profound in case of dependent variables (marital status ( $P=0.003$ ) and overweight ( $P=0.014$ )). In TUG test, the dependent variables, age ( $P=0.002$ ), marital status ( $P=0.081$ ), and cognitive function ( $P=0.048$ ) were influential on the TUG performance. In PPT, the independent variables, age ( $P=0.041$ ), gender ( $P=0.012$ ), marital status ( $P=0.058$ ), and cognitive function ( $P=0.001$ ), had a significant effect on the hand function.

**Conclusion:** Age-related changes, cognitive functions, and socioeconomic status were the most important factors affecting the functional performance of the elderly. Weight and gender also affected some aspects of functional performance. The author further recommends controlling and preventing loss of cognitive function and improving the social status and age-related changes in the older Iranian adults.

### Keywords:

Elderly, Performance, Health, Cognition, Physical fitness, Socio-economic status

### \* Corresponding Author:

**Zahra Mosallanezhad, PhD**

**Address:** Department of Physical Therapy, University of Social Welfare and Rehabilitation Sciences, Koodakyar Ave., Daneshjoo Blvd., Evin, Tehran, Iran.

**Phone:** +98 (21) 22180039

**E-mail:** [zmosallanezhad@yahoo.com](mailto:zmosallanezhad@yahoo.com)

## 1. Introduction

**A**ging is considered as a quiet and hidden biological process associated with certain degenerative changes in the body structure after maturation, causing a reduction in body functions. Since 1999, the UN Commission on Population and Development has considered the age of sixty as the entering to the elderly age, and those who have passed this age are considered as older adults [1]. Mortality reduction and increased life expectancy have caused an increase in the number of the elderly. In Iran, which is a developing country, based on 2011 census the elderly population has made up to 7% of the total population.

The predictions indicate a considerable increase of about 20-25% in elderly population by 2050 [2]. With aging, the incidence of chronic diseases and cognitive disorders also increases. In addition, some degenerative changes have been observed in the motor system, musculoskeletal system, and brain cortex, possessing a significant effect on the motor functioning in the elderly [3]. Performance deficiency and reduction in the quality of life are the problems experienced by 5-20% of the elderly [4]. For instance, in a study on the performance of the elderly, it was found that the most number of declining in the balance and walking speed occurred from the age of 60 to 70 years [5]. Low-speed walking and decreased physical activity are the major creators of disability, and this reduction or lack of physical activity can be the most important risk factors for the development of morbidity and even mortality [6].

The results of a recent study on the Iranian elderly showed that the performance disorders do have a high contagion, and the life quality and health status creates a dissatisfactory situation [7]. In a study comparing the Iranian and Swedish elderly, it was found that the Iranian elderly have a lower physical health, functional performance, and physical performance as compared to their Swedish counterparts, which justifies the importance of elderly care in Iran [8]. The functional performance include the necessary physical and mental activities for maintaining a healthy life [9] and can be measured with direct and indirect indexes [3].

In this study, to measure the performance capacity of the elderly three tests, such as speed walking and balance, getting up from the chair, and hand function has been used to evaluate the motor functioning of different motion body parts including the upper and the lower limbs. Habits and methods related to the physical ac-

tivities of each person are formed during the person's life, and various factors including cultural, social and economic indexes with the social level of the society affect it [10]. Different socioeconomic aspects, such as individual characteristics, urban life, and cultural issues (including perception, tendencies, and behaviors) can affect the health status of every person [11-13]. These dissimilar characteristics of the elderly cause a different rate of disability among the countries worldwide [14].

In this study, the survey questionnaires were used to assess the health status, mental performance, smoking habits, etc., in the elderly, which was self-reported. The survey results were validated are documented as an independent marker for morbidity, mortality, and performance in the elderly [15]. Specific aspects of social, cultural and environmental as well as health-related lifestyle and specific behaviors vary among different nations. The studies conducted in the area of the factors affecting different aspects of the performance in the elderly are mostly related to the western societies, which is very different from the status, lifestyle, beliefs and behaviors, and also some other personal, environmental and social factors in a country such as Iran [10, 11]. The study aimed at analyzing the relationship between demographic, health, physical fitness and socioeconomic determinants, and functional performance of elderly people.

## 2. Materials and Methods

### Participants

In this cross-sectional study, a sample size of 42 senior citizens consisting of 22 men and 20 women were analyzed. The target population included Iranian elderly with an age range of 60 to 91 years (mean age of  $70 \pm 8.8$  years). The samples were chosen in accordance with the convenience sampling method and with the power of 80% as based on the pre-study.

This study was conducted under the confirmation of the Ethics Committee of Tehran University of Social Welfare and Rehabilitation, in different parts of the city of Tehran in 2015. After receiving the complete data and information about the study conditions, the subjects filled in the satisfaction forms and questionnaires and gave their consent for participation. The inclusion criteria were 60 years of age and above [1], independent older adults who were capable of doing their daily activities with or without assistive devices [16], and mini mental state examination (MMSE) test score more than 23, which was used for detecting the cognitive disorders [17].

If any of the candidates had suffered from any severe musculoskeletal defects, visual and auditory deficiencies,

balance disorders, and frequent dizziness, which were registered in their medical records or at the time of conducting the study were excluded from the study. According to the opinion of the medical supervisor, these disorders could block the elderly cooperation in the study [18].

## Data collection

### Data collection instruments

The data-collecting questionnaire was used as a study instrument through which the age, height, weight, history of the diseases of various body systems, health status, and physical fitness was determined by the tester and completed in interviews and self-report [8]. The data related to the performance activities was collected through evaluating the elderly people during the test [8, 9].

### Background information

The data with relation to age, gender, height, weight, and hand function of the most of the samples were recorded. To measure the weight and height, a scale and a tape meter were used, respectively.

### Health status

The questions were answered in the self-report method. The questions included:

- How do you evaluate your health status? (Very bad, bad, almost good, good, very good),
- Do you feel a general tiredness? (Yes, no), and
- How much do the musculoskeletal problems affect your general health status? (Very much, much, average, little, very little).

And finally, various health problems such as heart-vascular system, respiratory system, digestive system, etc. which threaten the one's health were questioned. MMSE test was also used to analyze the individual's psychological health.

### Physical fitness status

The factors like body mass index (BMI), regular work out (yes, no), and physical fitness status (very bad, bad, almost good, good, very good) were recorded by the subjects in the self-report.

### Socioeconomic status

The subjects were asked to report their level of academic education (including under diploma, diploma, BA, MA, MSc., and any higher degrees) and marital status (the elderly ones who were living with their spouse were considered married, and those who have lost their spouse or divorced were considered single).

### Smoking/drinking habits

The subjects were questioned about their smoking or alcohol drinking habits and duration of the habits (at present, it's been five years I have stopped, it's been more than five years I have stopped).

### Functional performance

The elderly in this study were evaluated for their performance activities through the following tests:

#### Sit to Stand Test

This test is known as the 30-second-Chair-Stand Test (CST), which analyzes and evaluates the physical performance in the elderly people. The test analyzes the muscle strength around the knee muscle and lower limb in the elderly. The CST test is widely preferred in case of elderly because it is very simple and applicable for elderly with a lot of simple moving problems [19, 20]. The subject is asked to simultaneously sit down and stand up on a 43 cm chair for 30 sec, and the repetition of the action is calculated [21].

#### Time Up and Go (TUG) test

This is a functional test in which the walking speed, balance, and the one's performance are analyzed. It is also considered as a simple and cost effective way that includes daily movements [22, 23]. This test includes getting up from the 45 cm chair, walking for 3 m, turning and coming back, and then sitting down on the chair. The time taken by the subject for completion of the process is calculated [23].

#### Hand performance test

This test is known as the Purdue Pegboard Test (PPT), which was designed by Joseph Tiffin in 1948 to analyze the hand skill and the coordination between the two hands. This test is capable of analyzing two different features, such as the gross and fine hand movement and fingers. This test includes a board with some holes on it and some small iron bars and two kinds of washer, which are placed in the holes as per the instruction manual [24].

**Table 1.** The effective variables on the chair standing in the elderly.

Dependent Variable (Criterion)	Independent Variable (Predictor)	Standard Regression Coefficient	Non-Standard Regression Coefficient	T-Score	Sig.
30 second chair stand test	Overweight	-1.851	-0.376	-2.565	0.014
	Marital status (the married)	0.451	2.390	3.193	0.003

PHYSICAL TREATMENTS

Data analysis was conducted through a step-wise Logistic Regression model, with the use of SPSS version 19.

### 3. Results

#### Descriptive statistics

Almost about half of the participants were women (47.6%). The mean age of the women and men participating in this study was 79.7±8.68 years and 44.9±9.71years, respectively. Sixty-nine percent of the participant lived with their spouses, and 31% of them have lost their spouses or were divorced. Twenty-three of the total participants (54.7%) were overweight (BMI≥25). The MMSE mean score in the study was 27.9±1 (23≤MMSE≤30). Only 23% of the elderly had a regular exercise program, and exactly the same percentage of participants felt general tiredness. Fifty percent of the total elderly people reported good health status, and 47.7% of them reported almost good health status. Whereas the physical fitness status of 50% elderly was almost good, for 43% it was good, and for 7% it was very good.

#### Regression analysis

For each of the performance tests, a separate regression model was evaluated. In each of the models, one of the performance tests (Chair Sand Test, walking and balance speed test or hand performance test) was considered as the dependent variable, and the collection of the background variables, variables related to the health status, physical fitness, and socioeconomic status were chosen as the independent variables in the study.

#### Chair Stand Test (CST)

The regression coefficient and the level of the significance related to the effects of the dependent and independent variables in the Chair Stand Test showed that the variables of marital status (P=0.003) and overweight (0.014) had a significant influence on the performance of standing P-value from the chair (Table 1). The results showed that in the case of overweight elderly, the proportion specific to CST was 1.85 lower than the elderly with normal weight. In the elderly who lived with their spouses, the amount of CST was 2.93, which was more than those who lived alone.

#### Timed Up and Go Test

The analysis of regression coefficient and the level of the significance in relation to the effects of the independent variables on the independent variable of the speed and the balance of walking showed that the variables of age (P=0.002), marital status (P=0.081), and cognitive status (P=0.048) had a significant influence on TUG (Table 2). The results showed that:

- With the increase in the age, the time taken by the elderly for completion of the TUG test increased by 0.27, and
- With the increase of MMSE score, the time of the TUG test is reduced by 0.90.

In the elderly who lived with their spouses, the time of performing the TUG was 2.92 credits less than those who lived alone.

**Table 2.** The effective variables on the speed and the balance of the elderly more than 60 years old.

Dependent Variable (Criterion)	Independent Variable (Predictor)	Standard Regression Coefficient	Non-standard Regression Coefficient	T-Score	Sig.
Timed up and go	Age	0.472	0.269	3.384	0.002
	MMSE	-0.307	-0.896	-2.041	0.048
	Marital status (married)	-0.272	-2.924	-1.791	0.081

PHYSICAL TREATMENTS

Table 3. The effective variables on hand performance in the elderly population of more than 60 years old.

Dependent Variable (Criterion)	Independent Variable (Predictor)	Standard Regression Coefficient	Non-Standard Regression Coefficient	T-Score	Sig
Purdue Pegboard Test	Age	-0.317	-0.237	-2.111	0.041
	Gender (men)	-0.385	-5.032	-2.641	0.012
	MMSE*	0.489	1.876	3.550	0.001
	Marital status (married)	0.294	4.154	1.949	0.058

\*MMSE: Mini Mental State Examination.

### Hand Performance Test

The analysis of regression coefficient and the level of the significance in relation to the independent variables on the independent variables of hand performance showed that the variables of age (P=0.041), gender (P=0.012), marital status (P=0.058), and cognitive status (P=0.001) had a significant influence on the hand performance (Table 3). The results showed that:

- With increasing age, the PPT level decreased by 0.237,
- In the case of women subjects, the PPT score was more than 5.032 as compared to the male counterpart,
- With each unit increase in the MMSE score, the amount of PPT is increased to size 1.88, and
- Elderly who lived with their spouses, the PPT was 4.15 more than the elderly who lived alone.

## 4. Discussion

### Overview of the results

The overall results showed that marital status and overweight were the factors affecting the chair stand test, whereas the factors affecting the Timed Up and Go test were age, marital status, and the MMSE test score. In addition, the factors affecting hand performance were age, gender, MMSE test score, and marital status.

### Chair Stand Test

Based on our findings, the married elderly with lower weight could perform the chair stand test better. However, the overweight factor in the elderly can hasten the declining physical performance. This Age related process can cause weakness and morbidity and reduction in the quality of life in the elderly performances [25, 26]. Many factors from the physiologic and cognitive aspects are related to the chair stand test. Hence, this test is not

considered as the sole indicator of the power in the lower limbs.

In a study by Lord et al. (2002), the performing chair stand test in addition to knee flexor muscle highlighted the other important factors, such as body weight, pain, anxiety and worries, depression, mood, and other sensory-motor processes. Body weight, as an independent indicator, indicates that lifting and lowering a body with high weight requires more energy and work. On the other hand, the elderly performance in this study was not dependent on the height, gender, and age, which could be in the same way as suggested by our results.

The participants' motivation and perception along with the three other factors of anxiety, pain, and vitality are the influencing psychological factors in this test [27], which can be related to the marital status of the elderly. This refers to those who live with their spouses and are presented with less anxiety level, better physical performance, and more satisfaction in life [28]. In a study by Kaplan et al. (1993), they could not find any significant relationship between the weight and activities of daily living, functional performance and mobility of elderly subjects. [29]. But in this study, it was shown that there is a significant correlation between being married and physical performance in the elderly. Those who live with their spouse showed a higher physical performance [29]. In our study, gender did not influence the performance, but in the study by Cardoso et al. (2013), it was seen that men did show a lower performance [30].

TUG test is used to evaluate the performance of the lower limb and components such as speed and balance. The results of this study indicated that the physical performance is influenced by variables, such as age, marital status, and cognitive status of the subjects. In a previous study, it was observed that there was no difference between balance and walking characteristics between both the genders, which means the range and the age of starting disorders in men and women are the same. However, in lower age, balance problems are associated with more disorders in comparison to the walking speed [5].

Many studies have reported that the walking speed and balance decrease with aging [31-34]. Balance, walking speed, and mobility start decreasing from 40 to 60 years old [31, 34-36]. TUG test is a disability-indicating test. It is said that walking speed is related to the disability [6, 37, 38]. In a study by Samson et al. (2001), the results indicated that walking speed decreases with aging, but weight does not have any specific effects on walking speed, which is in the same line with the results of the present study [39]. In a study by Rosano et al. (2004), it was shown that there was a statistically significant relationship between the physical performance and cognitive performance. In this study, they used Teng-modified MMSE to evaluate the cognitive status of the elderly, which included the characteristics of the MMSE test. The results of this study supported the hypothesis that lower walking speed can be indicative of the weaker cognitive performance, which is in the same line with the present study results [40].

Among other findings of the present study, hand performance in both the genders was seen to decrease with aging. In fact, the more is the age, less is the PPT score [41]. The greater decrease was seen in elderly after the age of 65 years. The worse hand performance in the elderly is mostly related to the second and degenerative changes in the musculoskeletal, cardiovascular, and nervous system [42]. MMSE is one of the most applied methods for evaluating the cognitive disorders in the elderly [43]. Leveille et al. (1998) stated a clear relationship between the MMSE low scores and difficulty in performing daily activities [44].

In another study by Weuve et al. (2004), it was observed that those who have a high level of activity possessed better cognitive performances. And the cognitively active people showed less decrease in their performance [45]. As it is seen in the present study, in both the hand and walking speed tests, two variables of age and MMSE were influential. This was confirmed by other studies in which the MMSE score test decreased with aging, and this decrease intended towards more speed in elderly more than 70 years old [46, 47]. Marital status had significant relationship with other three performance tests. One of the reasons can be the effect of being married on the quality of life in aged population. Among other possibilities, it can be referred to the fact that some other tests are not just related to the muscle power and some psychological factors are also involved in determining the quality of performing these tests [27].

In a study by Kaplan (1993), the results indicated a relationship between marital status and physical performance

in the elderly [48]. The quality of life of the married elderly is of high level, and separated or divorced elderly have the least amount of life quality. Quality of life includes different aspects, such as physical performance, self-care, life satisfaction, depression, and anxiety [28, 49]. These findings are in the same line with the present study.

One the variables affecting hand performance is the gender, and this variable has been only observed in PPT in which used for determining the hand performance level. Senior women in comparison to their men counterparts showed a better performance. Gender differences in upper limbs performance are dissimilar in the studies. In the studies dealing with healthy samples, and PPT has been used as a test, and the results indicated that women's performance was much better than the men [24, 41].

In a comparative study which was among the elderly people in Iran and Sweden, it was observed that the level of physical activity in senior women was more than the men, which was opposite of the findings in Sweden [8]. In another study by Hackel et al. (1992), they used Jepsen test to evaluate hand performance. Based on the results, gender had a slight effect on the hand performance, but in some parts of the test, women performed better and faster than men [50]. On the other hand, in a study by Smith et al. (1999), which was about the slight hand movement of the elderly, the results showed no difference between both the genders [51]. In another study, the mean score of PPT for senior men was 8.20, and for women, it was 3.20, which was the opposite of the findings of this study [52]. Hence, it can be concluded that the women doing simple hand performance showed better performance than the men [53].

The present findings indicate a significant effect of the marital status, age, cognitive status of the elderly, gender, and also the weight of the elderly on different parts of the body performance, such as upper and lower limbs.

The most important and significant limitation of this study was the smaller sample size of the target population who were analyzed. Hence, the deduced findings might not be a generalized indicator for the total elderly population. Such limitation can be overcome by random sampling among the elderly in the society, and a larger sample size needs to be studied for better generalization of the outcomes.

### Application

The findings of the present study can provide useful information to recognize the effective of various factors

on the performance of the elderly and suggest effective ways to apply to their performance in the area of rehabilitation, such as improving the cognitive status of the elderly and reducing the mental pressure on them and their loneliness.

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## Conflict of Interest

The authors declared no conflict of interests.

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