Baltic Journal of Health and Physical Activity 2020; 12 (1): 20-31
Journal of Gdansk University of Physical Education and Sport
e-ISSN 2080-9999

ORIGINAL

doi: 10.29359/BJHPA.12.1.03

Predictors of mobility limitation in older adults: A structural equation modeling analysis

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Azam Jafari[1 CDEF], Nayyereh Aminisani[2 ABDEF], Seyed Morteza Shamshirgaran[2 ABE], Laven Rastgoo[1 BF], Neda Gilani[1,3 ACDEF]

[1] Department of Statistics and Epidemiology, Faculty of Health, Tabriz University of Medical Sciences, Tabriz, Iran.

[2] Healthy Ageing Research Centre, Neyshabur University of Medical Sciences, Neyshabur, Iran.

[3] Emergency Medicine Research Team, Tabriz University of Medical Sciences, Tabriz, Iran.

abstract

Background: In this study, the factors related to the functional limitation were studied simultaneously using structural equation modeling.

Material and methods: 1201 people aged 50 years and older were selected for this study using a stratified random sampling method from health centers of Bukan city in the northwest of Iran, in 2017. Trained interviewers collected information on demographic characteristics, socio-economic status, physical activity, history of falling/ fear of falling, visual and hearing condition, associated illnesses, social support, cognition, depression, assessed functional limitation and mobility of study participants. The structural equation modeling was used to analyze the data.

Results: The participants' mean age was 59.2 ±7.97 yrs, of whom 61% were women. The result showed that the proposed conceptual model fitted well CFI (0.97), RMSEA (0.04), SRMR (0.06). Age (β = -0.45, $p < 0.001$), gender (β = -4.55, $p = 0.004$), and economic status (β = -3.57, $p < 0.001$), physical activity (β = -10.35, $p = 0.025$) and socio-psychological activity (β = -1.59, $p < 0.001$) negatively, and the variables of educational level (β = 2.34, $p = 0.016$), marital status (β = 5.43, $p = 0.003$), cognitive function (β = 0.66, $p = 0.001$), living environment (ground floor*: β = 16.62, $p < 0.001$), duplex: (β = 5.19, $p = 0.055$), positively predicted the mobility limitation.

Conclusions: In this study, a range of socio-demographic factors, cognitive function, and living environment were identified as significant predictors of mobility limitation.

* There are two or three storey building in many cities of Iran, that the first floor, known as "pilot" or "ground floor", has access to a backyard but it is smaller and cheaper compared to the second or third floor. Older people usually prefer to live there because of no stairs and little garden in the backyard.

article details

Article statistics: **Word count:** 3,439; **Tables:** 4; **Figures:** 1; **References:** 52

Received: July 2019; **Accepted:** February 2020; **Published:** March 2020

Full-text PDF: http://www.balticsportscience.com

Indexation: Celdes, Clarivate Analytics Emerging Sources Citation Index (ESCI), CNKI Scholar (China National Knowledge Infrastructure), CNPIEC, De Gruyter - IBR (International Bibliography of Reviews of Scholarly Literature in the Humanities and Social Sciences), De Gruyter - IBZ (International Bibliography of Periodical Literature in the Humanities and Social Sciences), DOAJ, EBSCO - Central & Eastern European Academic Source, EBSCO - SPORTDiscus, EBSCO Discovery Service, Google Scholar, Index Copernicus, J-Gate, Naviga (Softweco, Primo Central (ExLibris), ProQuest - Family Health, ProQuest - Health & Medical Complete, ProQuest - Illustrata: Health Sciences, ProQuest - Nursing & Allied Health Source, Summon (Serials Solutions/ProQuest, TDOne (TDNet), Ulrich's Periodicals Directory/ulrichsweb, WorldCat (OCLC)

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interests: Authors have declared that no competing interest exists.

Corresponding author: Neda Gilani, Assistant Professor of Biostatistics, Department of Statistics and Epidemiology, Faculty of Health, Tabriz University of Medical Sciences, 5166614711 Tabriz, Iran; phone: (+98)4133340308; e-mail: gilanin@tbzmed.ac.ir, ORCID ID: https://orcid.org/0000-0002-5399-0277

INTRODUCTION

Ageing is associated with gradual, progressive and spontaneous erosive changes in most organs and physiological functions [1]. As people age, they will gradually lose some of their physiological and psychosocial functions, which degrade their functional status and increase their vulnerability and dependence [2, 3]. In Iran, the ageing population is increasing as well; it is predicted that by the year 2030, about 25–30% of the Iranian population will be made up by the elderly [4]. It is estimated that the elderly population in the United States, which is more than 40%, will be doubled by 2030. Probably, doubling the number of elderly people can affect reducing of people's health and the challenges of aging, such as the functional limitation [5]. In more than 40% of people aged 65 years and older, limitation of mobility has been reported [6]. Mobility is the ability of an individual to move (independently, or using auxiliary devices or vehicles) in her/his environment (from home to the neighborhood or living environment) [7]. The mobility function is the foundation of an active life that allows older adults to have a dynamic and active life [1]. Functional limitation is associated with various types of risk factors including overweight/obesity, and depression; it results in isolation and pain [8]. The importance of health assessment has been proven as an independent predicting factor of morality in elderly people. Poor health condition significantly leads to an increase in the limitation of mobility and the death rate [2, 7, 9, 10]. A study found that 5–10% of the elderly's death is due to low/lack of mobility [11]. A socio-economic status (personal characteristics, attitude and understanding) and independence in daily life activities can improve the health of older adults [12]. Physical activity and independence are important health predictors which can reduce the risk of disability and mortality [13, 14]. Improvement in the mental status and the cognition status is associated with regular physical activity [9]. Despite these benefits, physical activity among older adults is less than 150 min per week. National and international organizations have focused on increasing physical activity of older adults [15–17]. As people age, the amount of physical activities decreases, which results in reducing cognitive perception. On the other hand, physical activity improves the perceptual-cognitive status of older persons through two mechanisms: reducing the rate of depression and social stimuli (social activities) [18, 19].

Since no theory model based study has been applied to explain the limitation of mobility in Iranian older adults, the present research aimed to investigate the mobility limitation with a range of different factors, such as demographic characteristics, living environment status, economic status, physical activity, psychosocial support, cognitive-conceptual status, and anthropometric indices, using structural equation modeling.

In this research, the proposed conceptual model was derived from the comprehensive theory framework by Weber et al. [10]; upon which Meyer et al. [5] developed a model for identifying various forms of mobility function, which determines different levels of relationship between variables. Meyer et al.'s model provides a comprehensive approach to identifying, preventing, and reducing mobility disorders. The variables related to a mobility function in this model are the perceptual-cognitive status, physical health, psychological support, environmental status, and economic factors. The effects of factors such as gender, culture, and individuals' biography have been studied as well [5].

MATERIAL AND METHODS

Participants

In this study, 1201 elderly persons (with a mean age of 59.2 ±7.97 years, 61.8% female, 87.2% married) were selected by a stratified random sampling method, from health centers of Bukan city in northwest Iran, in 2017. Based on socio-economic characteristics, health centers were classified into four categories. Twenty percent of the centers were then randomly selected from each category. Next, the list of people over 50 years old was obtained from the province's health authority. Then, based on the total sample size and the proportion of people over fifty years in each center, non-replicable random numbers representing each individual were selected using random sampling.

The inclusion criteria were willingness to participate in the current study and providing consent, being 50 years and older, and a 5-year residency in Bukan; the exclusion criteria were severe psychological and cognitive impairment, and major physical disabilities. This research was approved by the Ethics Committee of the Tabriz University of Medical Sciences, (IR.TB2MED.REC.1397.737).

Measurement

The mobility limitation was assessed using the Medical Outcomes Study–Physical Functioning (MOS-PF) scale, which included ten questions based on limitations in daily activities to vigorous activities. Each question has three choices of "Yes, it is much limited, a little limited, not limited at all". Individuals can be categorized based on scoring from no limitation to severely limited. Its validity and reliability had also been confirmed [10].

Demographic characteristics (age, gender, marital status) and socioeconomic status (economic and education) were also completed. Moreover, physical activity was assessed using the Physical Activity Scale for the Elderly (PASE) questionnaire. The questionnaire was first designed by Richard, in Boston, in 1992 [20]. The questionnaire consists of three parts which assess different activities typically chosen by older adults (walking, recreational activities, exercise, housework, yard work, and caring for others; higher scores indicate greater physical activity. According to the scores for physical activity in the questionnaire for the elderly, individuals were divided into three groups: low activity (0–66), moderate activity (66–124), and high activity (>124) [21]. The validity and reliability of this questionnaire in Iran was confirmed by Ishaqi et al. in two stages [22].

To assess depression, the Center for Epidemiologic Studies Depression (CES-D) scale was used. The questionnaire is an internationally valid and reliable questionnaire for measuring depression. This tool is available in 4, 10, and 20-question versions; in the current study, the 10-question version was used. The questionnaire is scored in four alternatives (from 0, never; to 3, always). Higher values indicate more depression in patients [23]. The validity and reliability of this questionnaire in Iran was confirmed by Rabaka [24] and Rezaee et al. [25].

To assess the cognition status, the Mini-Mental State Examination (MMSE) test was completed. This test was designed by Marshal Folstein et al. in 1975 [26]. The MMSE consists of 6 parts which evaluate the cognitive deficits.

It is a 30-point questionnaire; the score of less than 24 points mean a possible cognitive impairment. Validity and reliability of this questionnaire were approved [26]. The Persian version of this tool was validated by Ansari et al. [27].

The 11-items Duke Social Support Index (DSSI) was used to assess the social support of the study participants. It measures two dimensions: social interaction and subjective support with the total score ranges between 11–33 which higher score indicates a higher level of support [28].

To calculate the Body Mass Index, participants' weight and height were measured. BMI was obtained as weight in kilograms divided by the square of height in meters.

STATISTICAL ANALYSIS

In this study, the STATA software (version 15, Stata Corp, College Station, Texas) was used to analyze the data. The mean (standard deviation) for quantitative data and the frequency (percentage) for qualitative data were reported. In the current analysis, quantitative variables were age, social support, cognitive impairment, number of falls, physical activity, number of comorbidities, depression, BMI, and the limitation of mobility; and quantitative variables were gender, education, marital status, economic status, and living environment. First, the bivariate correlation was used to examine the association between the study variables. Next, confirmatory factor analysis (CFA) was conducted to examine model fit among the latent factors and their indicators. There were two latent factors in this study; they were physical health (the number of associated illnesses, the number of falls, physical activity) and socio-psychological factors (depression score, support from family, support from friends).

After CFA, the structural equation model was conducted based on the theoretical model of Meyer et al [5] in order to examine the effect of the association between demographic, socio-psychological, living environment (a villa, part of a house, a duplex, ground floor), visual and hearing status, BMI, physical activity index, cognitive perception, and economic status on the mobility limitation. The missing data ranged from 1.21% to 11.21%. Since there were missing predictors, the maximum likelihood with the missing values method was used to handle the missing data. Stata's sem command includes the ability to estimate models with missing data using the full information maximum likelihood estimation (FIML) [29]. Before SEM analysis, multivariate normality was evaluated by examining the normality variables (estimating Mardia's coefficient of multivariate skewness and kurtosis). To assay, the significance of the relationship, the significant level of 5%, appropriate fitness, comparative fit index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) were used. In large sample sizes, χ^2/df was not suitable for model fitness. For this study, the following criteria were used, RMSEA ≤ .06, SRMR ≤ .08, and CFI ≥ .95. Since latent variables have several observed variables, it is necessary to assign an arbitrary value, usually 1.0, to a path linking the latent variable to one of its indicator variables to provide a unit of measurement for each latent variable [30].

RESULTS

1201 people were included in this research, of whom 734 (61.1%) were women. The participants' mean age was 59.2 ±7.97 years. Most participant (1048 = 87.2%) were married; 62% were illiterate and more than half of

the participants had income difficulties. The average BMI was 29.88 ±5.6, and 66.3% of people had at least one chronic disease. The hearing status was reported as good among about 64% of older adults. The average score for physical activity was 123.8 ±75.1, for social support 26.63 ±2.9, for cognitive perception 25.45 ±7.38, and for depression 7.90 ±2.86. (Table 1 and 2). Bivariate correlations among the observed variables, excluding covariates, are presented in Table 3.

Table 1. Quantitative characteristics of the study participants aged 50 and up, Bukan

Variable	Mean	SD*	Min-Max**	Skewness		Kurtosis	
				Statistic	SE***	Statistic	SE***
Age (year)	59.2	7.97	51–97	1.61	0.07	2.19	0.14
BMI (kg/m^2)	29.9	5.6	15.37–55.56	0.48	0.08	0.91	0.14
MMSE	25.5	7.4	15–245	2.17	0.07	1.92	0.15
Support from friends	7.84	1.04	5–12	-0.05	0.07	0.45	0.14
Support from family	18.81	2.95	7–21	-1.49	0.07	2.27	0.14
Physical activity	123.8	75.1	8–427	0.4	0.07	-0.04	0.14
Mobility limitation	84.7	23.6	4–100	-1.73	0.07	2.23	0.14
Number of falls	2.06	3.06	1–21	1.25	0.13	1.58	0.25
Depression	7.9	2.86	2–24	1.84	0.07	3.93	0.14

*Standard deviation; ** Minimum-Maximum; *** Standard error

Table 2. Descriptive statistics for quantitative variables among the study participants

Variable name		Number	Percentage
gender	male	467	38.8
	female	734	61.2
marital status	married	1048	87.2
	single / divorced / widow	153	12.8
education level	illiterate	742	61.8
	elementary / guidance	343	28.5
	high school and above	115	9.5
number of comorbidities	1 disease	427	35.5
	2 diseases	244	2.3
	more than 2	125	10
economic status	I live hard	835	69.7
	I do not have a problem	363	30.3
hearing status	excellent	19	1.5
	very good	126	1.4
	good	733	61.3
	medium	273	22.6
	bad	19	1.5
visual status	very good	82	6.8
	good	713	59.4
	medium	403	33.6
living environment	villa	223	18.6
	part of a house	218	18.2
	duplex	213	17.7
	ground floor	476	39.6

Table 3. Correlation Matrix of Study variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.BMI	--															
2.NOC	0.03	--														
3.NOF	0.001	0.08**	--													
4. PA	-0.03	0.02	-0.04	--												
5. Dep	0.10**	0.11**	0.08**	-0.03	--											
6.SFFr	-0.01	0.04	-0.04	0.07*	-0.07*	--										
7.SFFa	0.05	-0.08**	-0.12**	-0.06*	-0.22**	0.10**	--									
8. MMS	-0.01	-0.02	-0.04	0.02	-0.11**	0.10**	0.09**	--								
9. HS	-0.002	-0.02	-0.02	-0.02	0.07	-0.02	-0.004	-0.04	--							
10. VS	-0.05	0.14**	0.04	0.03	0.14**	-0.02	-0.14**	-0.05	0.25**	--						
11. Vil	-0.04	0.03	0.004	0.03	-0.04	0.02	-0.07*	0.07*	-0.07*	0.01	--					
12. POH	-0.02	0.11**	0.09**	-0.001	0.15**	-0.12**	-0.14**	-0.08**	0.03	0.09**	-0.22**	--				
13. Dup	-0.09**	0.06*	-0.04	0.03	-0.05	0.07*	-0.01	0.07*	-0.06*	0.05	-0.22**	-0.22**	--			
14. GrF	0.13**	-0.16**	-0.05	-0.04	-0.08**	0.001	0.20**	-0.02	0.13**	-0.14**	-0.39**	-0.38**	-0.37**	--		
15. ES	-0.002	-0.001	0.07*	0.01	-0.01	-0.05	-0.03	0.01	-0.09**	-0.02	-0.09**	0.01	0.04	-0.03	--	
16. ML	-0.02	-0.19**	0.08**	0.07*	0.28**	-0.07*	-0.23**	0.18**	0.04	-0.15**	-0.12**	-0.28**	-0.01	0.37**	-0.03	--

Abbreviation: BMI, body mass index; NOC, number of comorbidities; NOF, number of falls; PA, physical activity; Dep, depression; SFFr, support from friends; SFFa, support from family; MMS, Mini Mental State Examination; HS, hearing status; VS, visual status; Vil, Villa; POH, part of a house; Dup, Duplex; GrF, Ground Floor; ES, economic status; ML, mobility limitation.

* Correlation is significant at the .05 level;

** Correlation is significant at the .01 level.

A measurement model was fit allowing two latent variables to correlate with each other. This model appeared to fit the data well: RMSEA (0.05), CFI (0.95), and SRMR (0.08). Next, predictor models of mobility were tested including all two constructs and mobility determinants. The first tested model included all identified conceptual determinants of mobility and did not fit the data adequately [RMSEA = 0.09; CFI = 0.91; SRMR = 0.10]. Thus, the model was modified. This model appeared to fit the data approximately, better than the original model.

The final fitting indices of the explanatory model, CFI (0.97), RMSEA (0.04), and SRMR (0.06), were obtained, which indicate an appropriate fitting for the explanatory model based on the cut-points of the indices [30].

The mobility limitation was predicted negatively by variables such as age, gender, and economic status, and positively by variables such as educational level, marital status, cognitive perception, physical activity, and living environment (ground floor and duplex). However, the variables of the visual status, the hearing status, BMI, and living environment (villa, part of the house), have no significant relationship with the limitation of mobility. In the obtained model, all of the significant variables have a direct relationship with the endogenous variable that the relationship between them is as follows: age (β =-0.45, $p < 0.001$), gender (β = -4.55, $p = 0.004$), living environment (ground floor) (β = 16.62, $p < 0.001$), (duplex) (β = 5.19, $p = 0.055$), the state of cognitive function (β = 0.66, $p = 0.001$), physical activity (β = -10.35, $p = 0.001$), socio-psychological activity (β = -1.59, $p < 0.001$). The final model of mobility limitation and its predictors has been presented in Figure 1. The numbers of the paths represent the unstandardized values of the path coefficients (Table 4).

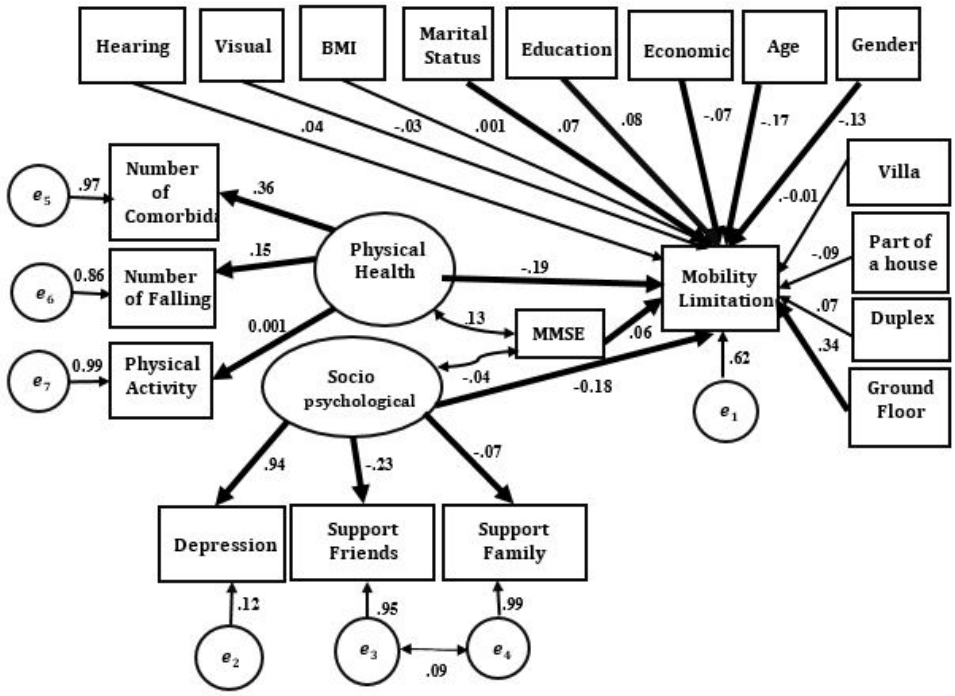

Fig. 1. Final model predicting mobility limitation: Standardized Results (N = 1201). Note: *p ≤ .05; thin lines represent weak relationships. Model fit indices CFI (0.97), RMSEA (0.04), and SRMR (0.06)

Table 4. Structural and measurement models of the relations among demographic, socio-psychological, living environment, visual and hearing status, BMI, physical activity index, cognitive perception, economic status, and the mobility limitation (unstandardized regression weight)

Variable		β*	SE**	P	CI 95%*** lower	CI 95%*** upper
Structural model of mobility						
Age		-0.45	0.08	<0.001	-0. 60	-0.30
Gender		-4.55	1.34	0.004	-7.17	-1.92
Marital Status		5.43	1.82	0.003	1.85	9.02
Education Level		2.34	0.97	0.016	0.44	4.23
Economic Status		-3.57	0.08	<0.001	-0.60	-0.30
Visual Status		-1.33	0.97	0.171	-3.23	0.57
Hearing status		0.85	0.54	0.111	-0.20	1.90
BMI		-0.02	0.10	0.883	-0.22	0.19
MMSE		0.66	0.20	0.001	0.26	1.04
Physical Health		-10.35	4.60	0.025	-19.37	-1.30
Living environment	Villa	0.30	2.69	0.910	-4.98	5.58
	Part of a house	-4.26	2.70	0.114	-9.56	1.02
	Duplex	5.19	2.71	0.055	-0.12	10.50
	Ground floor	16.62	2.56	<0.001	11.60	21.65
Socio-Psychological		-1.59	0.24	<0.001	-2.06	-1.12
Measurement model						
Socio-psychological						
Depression£		0.94	0.003	<0.001	0.93	0.94
Support from Friends		-0.03	0.01	0.014	-0.05	-0.01
Support from Family		-0.23	0.03	<0.001	-0.28	-0.17
Physical Health						
Number of Comorbidities£		0.35	0.05	<0.001	0.26	0.44
Number of Falls		0.19	0.08	0.023	0.03	0.35
Physical Activity		0.17	0.07	0.015	0.03	0.31

* Unstandardized regression weight ** Standard Error *** Confidence Interval £ Standardized regression weight result

DISCUSSION

In the required model, the variables of demographic characteristics (age, gender, educational level, and marital status), economic status, living environment, the state of cognitive function, socio-psychological and physical activity had a significant relationship with the limitation of mobility. In a study by Alberto et al. (2014) that examined the relationship of depression and food intake with the mobility function in elderly people, the result showed that among the studied variables, the demographic characteristics (age, gender, educational level, and marital status) had a relationship with the mobility function [31]. In the study of Lin, which evaluated the limitation of mobility in elderly people, among the studied variables, there was a significant relationship between the variable of age, gender, educational level, and marital status, in a way that most single women had lower age and education [1]. Robinson et al. (2013) concluded in their study that increasing the risk factors (ageing) could lead to the limitation of mobility [32], so that, as the age increases, the rate of mobility function decreases. Ageing leads to consequences such as reduced bone density, loss of muscle mass, and cell membrane, weakness of the proximal muscles, and the unstable knee due to the weakness of the quadriceps muscles, which overshadow the elderly's mobility [33]. Aging leads to muscle lysis (sarcopenia) and reduces one's ability [34]. Inactivity and bed rest in the elderly reduces protein synthesis, muscle mass, and muscle power, increases fat mass, and leads to osteoporosis in the elderly. Many age-related changes in the musculoskeletal system result from not having enough physical activity that leads to the incidence of debilitating fractures [34, 35]. The limitation of mobility in elderly people who walk and climb stairs results from the muscles being weak [36]. Concerning the relationship between gender and limitation of mobility, Vance et al. (2016) stated that the rate of the mobility function in men is better than that among women [18]. Women's daily activity rate is lower than that of men, which can be related to women's lifestyle and low mobility in the Iranian society [33]. Older women are less independent in their everyday life than elderly men [37]. On the other hand, the gender of the elderly affects their physical performance; elderly women have much lower physical performance [32]. Physical activity reduces the risk of falling, decreases the limitation of mobility, as well as delays balance disorders in elderly people [34, 38]. Given the fact that the level of elderly women's physical activity in Iran is lower, there is a greater likelihood of collapse and imbalance, which can lead to their limitation of mobility. Also, married elderly people are less limited in mobility than those who do not have a spouse. As a matter of fact, married people are mentally active and have social support. Married people have less psychosocial stress, and emotionally have a strong and close relationship with their spouse [39]. Hakan Seon in his study showed that married people are more exposed to social stimuli and have a more social contribution that single people [40]. In Meyer's research, marital status had a significant relationship with the limitation of mobility, but the educational level did not [5].

The inadequate and poor economic status is effectively related to the limitation of mobility in elderly people; the low level of education and the lack of proper occupational status are predictive factors for cognitive-perceptual disorders and mobility disorders [18]. In the present study, there was a direct relationship between the economic status and the limitation of mobility. In the research by Mosallanejad et al. (2017), the results showed that there is a significant relationship between the economic status and mobility limitation [41]. A better economic status leads to a better health condition, better access to health

resources and insurance, reduction in the number of chronic diseases, and an increase in physical activity. A better economic status leads to more physical activity, resulting in more individual health and mobility function. A low economic status is the reason for differences in access to health care, health-related behaviors, psychosocial stress [41, 42]. Previous studies found a strong correlation between the general health status [41, 43]. People with a low economic status are always worried about their health; these people always have higher treatment costs than people with a high economic status [41]. The living environment is an effective factor in limitation of mobility, so that the people who can easily be physically active in their living environment have an improved mobility function [44]. The study of Umstattd Meyer et al. [5] has shown that there is a strong link between the living environment of the elderly with their walking, driving, and physical activities. A suitable living environment, access to park, game, and other facilities for exercising have a positive effect on health. Both marital and non-marital resources affect the pattern of one's life [45]. The study of Orna et al. reported that there is a strong correlation between mobility limitation and the cognitive status. Poor cognitive function predicts the weak mobility function [46]. Research showed that education and the level of education have a significant relationship with the cognitive-perceptual status, and thus educating an individual leads to the activation of brain networks. Moreover, a low level of education causes different types of stress, and reduction in individuals' health, and thereby reduces cognitive perceptions. The level of people's perception, cognition, and knowledge is associated with health factors, increases the level of physical activity and reduces the mobility limitation [41]. Angevaren et al. [47] examined the effect of physical activity and physical fitness on improving cognitive performance. The results showed that physical activity improves cardio-respiratory capacity and therefore improves the cognitive status and mobility function. In this study, the perceptual-cognitive status is related to the status of mobility limitation. Elbaz et al. [48] stated that cognitive ability is directly related to mobility function. In a study by Vance et al. [18], a communication pathway between age and the cognitive-perceptual status was introduced; older people are in a lower cognitive-perceptual status. In Foong's study, it has been pointed out that the individual's cognitive performance is negatively correlated with social stresses. Social stresses include intellectual stress, depression, loneliness, and anxiety. On the other hand, reduction of the lack of functioning of the hypothalamic-pituitary-adrenaline pathway and inflammation leads to a reduction of cognitive perceptions [39]. Diniz et al. [49] also found in their study that depression leads to a reduction in the perceptual-cognitive status with a particular mechanism. Boss et al. [50] showed that loneliness leads to perceptual disorders, and this correlation is due to the reduction of social support and intellectual stimuli. Seeman et al. [51] also referred to a lack of social support as one of the reasons for the reduction of cognitive perceptions in elderly people. Anxiety causes negative events in people's life and thus leads to chronic stresses and negative emotions and causes negative effects in the brain. As we age, physical changes occur in the human brain; these changes are microscopic and macroscopic, so that the mass and the size of neurons reduces, which is associated with perceptual-cognitive impairment [39]. Another determinant variable in mobility limitation in this study was socio-psychological. People who lived with relatives or who had more social support had less movement restriction. In a study by Lin [1], depression had a significant relationship with mobility limitation, with depression leading to motor disability and mobility limitation. In a study by Foong et al. [39], there was a significant relationship between depression and

motor function, so that reducing depression would improve cognitive and motor function in older people. In a study by Vance et al. [18], the results showed that depression had a significant relationship with the cognitive and perceptual status and thus influenced the motor function. Another variable in this study was physical activity. In Kasser et al. study, the results showed that physical activity leads to an improvement in the mobility function and mobility disorders [44]. Boulton et al. [52] examined the effects of physical activity in elderly people, which showed that physical activity reduced the amount of depression and improved mobility function and balance. In their study, Vance et al. [18] found that physical activity improves the cognitive status and reduces depression; thus it improves the mobility function. In our country, because people's average physical activity, especially among the elderly, during a day, is below the global average, it could be a factor of the limitation of mobility.

CONCLUSIONS

The results of this study indicate that the designed comprehensive model was valid enough to assess the limitation of mobility in older adults in Iran. The results of this study can be a help to improve the quality of life of people and their social health, to identify valid instruments, and to conduct pilot studies for many elderly people for the desired model.

Being cross-sectional is among the limitation of the study so that the effects of some examined variables can be temporary and transient. Therefore, longitudinal studies (cohort) are needed to evaluate the predictors of the mobility function. Some variables related to lifestyle, including a diet that can affect the limitation of mobility, have not been considered. It is also suggested that the future research would study the ethnic groups in different provinces and urban-rural contexts in Iran.

REFERENCES

[1] Lin S-I, Lee H-C, Chang K-C, Yang Y-C, Tsauo J-Y. Functional mobility and its contributing factors for older adults in different cities in Taiwan. J Formosan Med Assoc. 2017;116(2):72–9. https://doi.org/10.1016/j.jfma.2016.01.011

[2] Liu J, Wang X-Q, Zheng J-J, et al. Effects of Tai Chi versus proprioception exercise program on neuromuscular function of the ankle in elderly people: a randomized controlled trial. Evid Based Complement Alternat Med. 2012;Article ID 265486. https://doi.org/10.1155/2012/265486

[3] Chiang KJ, Chu H, Chang HJ, et al. The effects of reminiscence therapy on psychological well-being, depression, and loneliness among the institutionalized aged. Int i Geriatr Psychiatr. 2010;25(4):380-8. https://doi.org/10.1002/gps.2350

[4] Maghsoodnia S. Primary elder health care in Iran. Tehran: University of Social Welfare and Rehabilitation Sciences Publication; 2006.

[5] Umstattd Meyer MR, Janke MC, Beaujean AA. Predictors of older adults' personal and community mobility: Using a comprehensive theoretical mobility framework. The Gerontologist. 2013;54(3):398-408. https://doi.org/10.1093/geront/gnt054

[6] Park MH. Informant questionnaire on cognitive decline in the elderly (IQCODE) for classifying cognitive dysfunction as cognitively normal, mild cognitive impairment, and dementia. Int Psychogeriatrics. 2017;29(9):1461-7. https://doi.org/10.1017/S1041610217000965

[7] Prohaska TR, Anderson LA, Hooker SP, Hughes SL, Belza B. Mobility and aging: Transference to transportation. J Aging Res. 2011;Article ID 392751. https://doi.org/10.4061/2011/392751

[8] Bohannon PL, Fan W, Flaster ME, Perinkulam S. Methods and apparatus for mapping source schemas to a target schema using schema embedding. Google Patents; 2011.

[9] Satariano WA, Guralnik JM, Jackson RJ, Marottoli RA, Phelan EA, Prohaska TR. Mobility and aging: New directions for public health action. Am J Publ Health. 2012;102(8):1508-15. https://doi.org/10.2105/AJPH.2011.300631

[10] Weber SCP, Michelle M, Menec VH. Mobility in older adults: a comprehensive framework. The Gerontologist. 2010;50(4):443-50. https://doi.org/10.1093/geront/gnq013

[11] Martin H, Syddall H, Dennison E, Cooper C, Sayer A. Relationship between customary physical activity, muscle strength and physical performance in older men and women: Findings from the Hertfordshire Cohort Study. Age and Ageing. 2008;37(5):589-93. https://doi.org/10.1093/ageing/afn148

[12] Jørgensen TSH, Nilsson CJ, Lund R, Siersma V, Fors S. Intergenerational relations and social mobility: Social inequality in physical function in old age. Arch Gerontol Geriatr. 2019;80:58-64. https://doi.org/10.1016/j.archger.2018.10.006

[13] Chakravarty EF, Hubert HB, Krishnan E, Bruce BB, Lingala VB, Fries JF. Lifestyle risk factors predict disability and death in healthy aging adults. Am J Med. 2012;125(2):190-7. https://doi.org/10.1016/j.amjmed.2011.08.006

[14] Sobhani F, Haghshenas R, Rahimi M. Effect of eight weeks aerobic training and supplementation of green tea on apelin plasma levels and insulin resistance in elderly women with type 2 diabetes. J Mazandaran Uni Med Sci. 2019;28(170):84-93.

[15] Patti F, Vila C. Symptoms, prevalence and impact of multiple sclerosis in younger patients: A multinational survey. Neuroepidemiology. 2014;42(4):211-8. https://doi.org/10.1159/000360423

[16] Coleman CI, Sidovar MF, Roberts MS, Kohn C. Impact of mobility impairment on indirect costs and health-related quality of life in multiple sclerosis. PLoS One. 2013;8(1):e54756. https://doi.org/10.1371/journal.pone.0054756

[17] Bethoux F. Gait disorders in multiple sclerosis. Continuum. Multiple Sclerosis. 2013;19(4):1007-22. https://doi.org/10.1212/01.CON.0000433286.92596.d5

[18] Vance DE, Marson DC, Triebel KL, Ball KK, Wadley VG, Cody SL. Physical activity and cognitive function in older adults: The mediating effect of depressive symptoms. J Neurosci Nurs. 2016 Jul-Aug;48(4):E2-E12. https://doi.org/10.1097/JNN.0000000000000197

[19] Esmaeili A, Haghshenas R. The effect of eight weeks concurrent training and supplementation of L_arginine on stress oxidative and lipid profile in elderly men. Horizon Med Sci. 2019;25(1):43-9.

[20] Burns A, Lawlor B, Craig S. Assessment scales in old age psychiatry: CRC Press; 2004. https://doi.org/10.1201/b14307

[21] Taghipour M, Hosseini SR, Pouraria SJ. The relationship between physical activity and balance control in the elderly. Iran J Ageing. 2016;10(4):60-7.

[22] Eshaghi R MA, Asgarian R, Sohrabi N. The impact of education based on religious studies on physical activity. Iran J Med Educ. 2011;5(10):1281-88.

[23] Finkelstein FO, Finkelstein SH. Depression in chronic dialysis patients: Assessment and treatment. Nephrology Dialysis Transplantation. 2000;15(12):1911-3. https://doi.org/10.1093/ndt/15.12.1911

[24] Drayer RA, Piraino B, Reynolds III CF, et al. Characteristics of depression in hemodialysis patients: symptoms, quality of life and mortality risk. General Hospital Psychiatry. 2006;28(4):306-12. https://doi.org/10.1016/j.genhosppsych.2006.03.008

[25] Rezaei S, Afsharnezhad T, KAFI M, Soltani R, Falah KS. Relationship between depression and coping strategies in chronic back pain patients. 2009.

[26] Folstein MF, Folstein SE, McHugh PRJJopr. "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12(3):189-98. https://doi.org/10.1016/0022-3956(75)90026-6

[27] Ansari NN, Naghdi S, Hasson S, Valizadeh L, Jalaie SJ. Validation of a mini-mental state examination (MMSE) for the Persian population: A pilot study. Appl Neuropsychol. 2010;17(3):190-5. https://doi.org/10.1080/09084282.2010.499773

[28] Vergara I, Vrotsou K, Orive M, Gonzalez N, Garcia S, Quintana JM. Factors related to functional prognosis in elderly patients after accidental hip fractures: A prospective cohort study. BMC Geriatr. 2014;14(1):124. https://doi.org/10.1186/1471-2318-14-124

[29] Medeiros RA. Including auxiliary variables in models with missing data using full-information maximum likelihood estimation. 2013 Stata Conference 18, Stata Users Group.

[30] Kline RB. Principles and practice of structural equation modeling: Guilford publications; 2015.

[31] Ávila-Funes JA, Gray-Donald K, Payette H. Association of nutritional risk and depressive symptoms with physical performance in the elderly: the Quebec longitudinal study of nutrition as a determinant of successful aging (NuAge). J Am Coll Nutr. 2008;27(4):492-8. https://doi.org/10.1080/07315724.2008.10719730

[32] Robinson SM, Jameson KA, Syddall HE, et al. Clustering of lifestyle risk factors and poor physical function in older adults: the Hertfordshire cohort study. J Am Geriatr Soc. 2013;61(10):1684-91. https://doi.org/10.1111/jgs.12457

[33] Masoumi N, Jafroudi S, Ghanbari Khanghah A, Kazemnejad Leili EJ. Assessment of retired elderly's people autonomy and its affecting factors in Rasht. JoHN, Midwifery. 2011;21(1):46-51.

[34] Di Monaco M, Vallero F, Di Monaco R, Tappero R. Prevalence of sarcopenia and its association with osteoporosis in 313 older women following a hip fracture. Arch Gerontol Geriatr. 2011;52(1):71-4. https://doi.org/10.1016/j.archger.2010.02.002

[35] Kim S-H, Kim T-H, Hwang H-J. The relationship of physical activity (PA) and walking with sarcopenia in Korean males aged 60 years and older using the Fourth Korean National Health and Nutrition Examination Survey (KNHANES IV-2, 3), 2008–2009. Arch Gerontol Geriatr. 2013;56(3):472-7. https://doi.org/10.1016/j.archger.2012.12.009

[36] Rantanen T, Guralnik JM, Sakari-Rantala R, et al. Disability, physical activity, and muscle strength in older women: The women's health and aging study. Arch Phys Med Rehab. 1999;80(2):130-5. https://doi.org/10.1016/S0003-9993(99)90109-0

[37] Alizadeh M, Rahimi A, Arshinji M, et al. Physical health status and socio-economic outcomes on elderly in Tehran metropolitan area. 2013;13(1):29-37.

[38] Haghshenas R, Avandi M, Jalili N. The effect of 8 weeks of concurrent training with L-arginine supplementation on 8-isoPGF2α, SOD, GPX and CAT in elderly men. J Sport Biosci. 2017;9(4):515-27.

[39] Foong HF, Hamid TA, Ibrahim R, Haron SA, Shahar S. Predicting cognitive function of the Malaysian elderly: a structural equation modelling approach. Aging Ment Health. 2018;22(1):109-20. https://doi.org/10.1080/13607863.2016.1231172

[40] Abbema E, Van Assema P, Kok G, De Leeuw E, De Vries N. Effect evaluation of a comprehensive community intervention aimed at reducing socioeconomic health inequalities in the Netherlands. Health Promot Int. 2004;19(2):141-56.

[41] Mosallanezhad Z, Sotoudeh GR, Jutengren G, et al. A structural equation model of the relation between socioeconomic status, physical activity level, independence and health status in older Iranian people. Arch Gerontol Geriatr. 2017 May-Jun;70:123-129. http://doi.org/10.1016/j.archger.2017.01.004.

[42] Park E-J, Sohn HS, Lee E-K, Kwon J-W. Living arrangements, chronic diseases, and prescription drug expenditures among Korean elderly: Vulnerability to potential medication underuse. BMC Publ Health. 2014;14(1):1284. https://doi.org/10.1186/s12889-015-1834-y

[43] Bostan C, Oberhauser C, Stucki G, Bickenbach J, Cieza A. Which environmental factors are associated with lived health when controlling for biological health? A multilevel analysis. J Rahabil Med. 2015;15(1):508.

[44] Kasser SL, Kosma M. Social cognitive factors, physical activity, and mobility impairment in adults with multiple sclerosis. JBM. 2017:1-8.

[45] McAuley E, Konopack JF, Morris KS, et al. Physical activity and functional limitations in older women: influence of self-efficacy. J Gerontol B. 2006;61(5):P270-P7. https://doi.org/10.1093/geronb/61.5.P270

[46] Donoghue OA, Horgan NF, Savva GM, Cronin H, O'regan C, Kenny RA. Association between timed Up-and-Go and memory, executive function, and processing speed. Cochrane Systematic Review - Intervention 2012;60(9):1681-6. https://doi.org/10.1111/j.1532-5415.2012.04120.x

[47] Angevaren M, Aufdemkampe G, Verhaar H, Aleman A, Vanhees L. Physical activity and enhanced fitness to improve cognitive function in older people without known cognitive impairment. 2008;3(3):1-73. https://doi.org/10.1002/14651858.CD005381.pub3

[48] Elbaz A, Vicente-Vytopilova P, Tavernier B, et al. Motor function in the elderly: Evidence for the reserve hypothesis. Neurology. 2013;81(5):417-26. https://doi.org/10.1212/WNL.0b013e31829d8761

[49] Diniz BS, Butters MA, Albert SM, Dew MA, Reynolds CF. Late-life depression and risk of vascular dementia and Alzheimer's disease: Systematic review and meta-analysis of community-based cohort studies. Br J Psychiatr. 2013;202(5):329-35. https://doi.org/10.1192/bjp.bp.112.118307

[50] Boss L, Kang D-H, Branson S. Loneliness and cognitive function in the older adult: A systematic review. Int Psychogeriatr. 2015;27(4):541-53. https://doi.org/10.1017/S1041610214002749

[51] Seeman TE, Miller-Martinez DM, Stein Merkin S, Lachman ME, Tun PA, Karlamangla AS. Histories of social engagement and adult cognition: Midlife in the US study. J Gerontol B. 2011;66(suppl_1):i141-i52. https://doi.org/10.1093/geronb/gbq091

[52] Boulton ER, Horne M, Todd C. Multiple influences on participating in physical activity in older age: Developing a social ecological approach. Health Expect. 2018;21(1):239-48. https://doi.org/10.1111/hex.12608

Cite this article as:

Jafari A, Aminisani N, Shamshirgaran SM, Rastgoo L, Gilani N.
Predictors of mobility limitation in older adults: A structural equation modeling analysis
Balt J Health Phys Act. 2020;12(1):20-31
doi: 10.29359/BJHPA.12.1.03