Turkish Journal of Geriatrics
DOI: 10.31086/tjgeri.2018.68
2018;21 (4):607-616

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RESEARCH

DEVELOPMENT OF THE PHYSICAL ACTIVITY BARRIERS SCALE FOR ELDERLY INDIVIDUALS

Abstract

Introduction: The aim of this study was to develop the Physical Activity Barriers Scale for the Elderly.

Materials and Method: We developed the Physical Activity Barriers Scale for the Elderly. Fifteen elderly individuals participated in pilot testing to determine the intelligibility of the remaining 30 items after content validity assessment. After confirming the appropriateness of the scale, we administered it to 214 individuals aged >65 years (mean age: 73.9±7.7 years). We applied the scale again 3-7 days later to determine test–retest reliability using the correlation coefficient. Exploratory and confirmatory factor analysis was used to determine the factor structure. Internal consistency was determined with Cronbach's alpha. The correlation with the International Physical Activity Questionnaire and the Nottingham Health Profile was assessed for construct validity.

Results: Exploratory factor analysis revealed three scale factors: personal, environmental factors and daily routines. Test–retest reliability and internal consistency of the scale was good (r=0.869, Cronbach's alpha=0.918). Negative correlation was found between the Scale and International Physical Activity Questionnaire (r=–0.340, p<0.001) and a positive correlation between the Scale and Nottingham Health Profile (r=0.693, p<0.001).

Conclusion: The Physical Activity Barriers Scale for the Elderly is a valid and reliable measurement that can be used to determine the factors that prevent seniors from engaging in physical activity. With this scale, physical activity barriers can be identified, and arrangements can be made to help improve the level of physical activity among elderly individuals.

Keywords: Aged; Exercise; Questionnaire

ARAŞTIRMA

YAŞLI BİREYLER İÇİN FİZİKSEL AKTİVİTE BARİYERLERİ ÖLÇEĞİNİN GELİŞTİRİLMESİ

Öz

Giriş: Bu çalışmanın amacı Yaşlılar İçin Fiziksel Aktivite Bariyerleri Ölçeği'nin geliştirilmesiydi.

Gereç ve Yöntem: Yaşlılar İçin Fiziksel Aktivite Bariyerleri Ölçeği'ni geliştirdik. Kapsam geçerliliği değerlendirmesinden sonra kalan 30 maddenin anlaşılabilirliğini belirlemek için on beş yaşlı birey pilot teste katıldı. Ölçek uygunluğunu doğruladıktan sonra 65 yaş üzeri 214 bireye (yaş ortalaması:73.9±7.7 yıl) uyguladık. Korelasyon katsayısını kullanarak test-tekrar test güvenilirliğini belirlemek için ölçeği tekrar 3-7 gün sonra uyguladık. Faktör yapısını belirlemek için açıklayıcı ve doğrulayıcı faktör analizi kullanıldı. İç tutarlılık Cronbach alpha katsayısı kullanılarak belirlendi. Yapı geçerliliği için Uluslararası Fiziksel Aktivite Anketi ve Nottingham Sağlık Profili ile ilişki değerlendirildi.

Bulgular: Açıklayıcı faktör analizi üç ölçek faktörü ortaya çıkardı: kişisel, çevresel faktörler ve günlük rutinler. Ölçeğin test- tekrar test güvenirliği ve iç tutarlılığı iyi bulundu (r:0,869; Cronbach alpha:0.918). Ölçek ile Uluslararası Fiziksel Aktivite Anketi arasında negatif ilişki (r=-0.340; p<0.001); Nottingham Sağlık Profili skoru arasında pozitif ilişki (r=0.693; p<0.001) bulundu.

Sonuç: Yaşlılar İçin Fiziksel Aktivite Bariyerleri Ölçeği, yaşlıların fiziksel aktivite yapmalarına engel olan faktörlerin belirlenmesinde kullanılabilecek geçerli ve güvenilir bir ölçektir. Bu ölçekle, fiziksel aktivite engelleri tanımlanabilir ve yaşlı bireyler arasında fiziksel aktivite düzeyinin geliştirilmesine yardımcı olmak için düzenlemeler yapılabilir.

Anahtar sözcükler: Yaşlı; Egzersiz; Anket

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Received: 24/05/2018
Accepted: 04/12/2018

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INTRODUCTION

Regular physical activity (PA) is important for maintaining general health in later life. At advanced ages, functional capacity decreases, and muscle atrophy, muscle weakness, loss of aerobic capacity occur. These conditions are increased with sedentary lifestyles. Therefore, regular PA is necessary for maintaining physical independence (1). In elderly individuals, regular PA is associated with higher self-esteem, improved quality of life (QoL) and reduced physical constraints and depressive symptoms (2,3). Although PA is well-known to be beneficial for health, inactivity is common among elderly individuals (4).

Participation in PA is a dynamic and complex process, influenced by individual and environmental factors (1,5). According to the International Classification of Functioning, Disability and Health (ICF) developed by the World Health Organization (WHO), personal and environmental factors affect PA behaviours (6). Poor health, poor balance, lack of role models, lack of motivation, lack of time, bad weather, lack of walking roads are examples of perceived PA barriers for elderly individuals (1,5,7).

Recent studies have emphasised the importance of PA. Evidence suggests that PA is associated with increased life expectancy, years without impairment in daily living activities, increased longevity and prevention of chronic illness (8,9). Physical activity is important for the health and quality of life of the elderly (10). To increase elderly individuals' physical independence levels, we need to determine PA barriers by means of an age-specific evaluation method. When the scales used to determine physical activity barriers in elderly people are examined, it is seen that subdivisions of some questionnaires which are non-specific for elderly are used (11,12). Qualitative studies in the elderly do not provide comprehensive data on physical activity barriers. In qualitative and quantitative studies, it is seen that the physical activities only performed on the outside, elderly people with some diseases and living in a certain living area, physical activity barriers in a particular category or barriers of a certain type of physical activity were evaluated (1,5). A structured scale assessing the physical activity barriers of the elderly living in various living areas was not found. Therefore, the aim of this study was to develop the Physical Activity Barriers Scale for the Elderly (PABS-E) and to investigate its reliability, internal consistency and validity.

MATERIALS AND METHOD

This study consisted of two phases. We determined content validity, item development and item refinement during the first phase. During the second phase, we measured criterion validity, internal consistency and test–retest reliability. The study included 214 voluntary elderly individuals who were living in the nursing home or in the community. Inclusion criteria were a) age ≥65 years, b) literate. Exclusion criteria were a) dementia or cognitive disorders, b) bedridden, c) acute illness. Individuals living in nursing homes were evaluated by visiting nursing homes. The elderly living in the community were evaluated by visiting their homes or a senior club that people can meet and socialise to build up relationships. This study was approved by the Hacettepe University Ethical Committee. Informed written consent was obtained from all participants.

Item generation

We conducted a literature review to identify qualitative and quantitative studies that employed questionnaires to identify PA barriers for elderly individuals. The item pool was formed based on questionnaires previously used in the literature. After consultation with geriatric rehabilitation experts, 84 items were generated.

Content validity

After generating the items, we sent measurements to panellists consisting of five

experienced people in the field of geriatric rehabilitation. The content validity ratio (CVR) for individual scale items was calculated as CVR=(Ne – N/2)/(N/2), where Ne is the proportion of experts who rated the item as 1 on a 3-point scale, and N is the total number of experts. For the five panellists, the cut off point for excellent CVR was set at ≥0.99. Of the 84 items, 30 proved valid. The content validity index (CVI) was calculated as the mean of CVR. The CVI for the entire scale was calculated as the proportion of the number of items deemed content valid. CVI of the scale was calculated as 0.775, and CVI≥0.67 was considered excellent.

Pilot study

After content validity assessment was completed, we reviewed each item for structure and clarity, eliminated redundant inquiries and modified ambiguous wording. To test user perceptions, a pilot study was completed with 15 elderly individuals. Items were scored using a 5-point Likert scale (1-strongly disagree, 2-disagree, 3-undecided, 4-agree and 5-strongly agree). Elderly individuals who participated in the pilot study did not discriminate between 1-2 points and between 3-4 points, so the scoring was changed to a 3-point Likert-type scale (1-disagree, 2-undecided and 3-agree).

Participants completed the PABS-E, International Physical Activity Questionnaire (IPAQ) and Nottingham Health Profile (NHP). The following demographic data were collected. Participants completed the PABS-E again 3–7 days later.

To determine participants' QoL, we used the Turkish version of the NHP, a generic QoL measurement. The measurement consists of six subheadings that tested PA, energy level (EL), pain (P), social isolation (SI), sleep (S) and emotional reactions (ER) using a "yes" or "no" response. Each subheading is assessed using a score ranging between 0 and 100. Low scores indicate good QoL (13).

We determined PA level using the Turkish version of the IPAQ-SF (14). The IPAQ-SF assesses PA over the preceding 7 days (15) and is a useful measure of PA in elderly individuals (16). The short form records four activity intensities; vigorous intensity, moderate intensity, walking and sitting (17). Total daily PA [Metabolic Equivalent of Task (MET, min/day)] was obtained by summing the product of duration within each item by a MET value (MET is metabolic equivalent; 1 MET=resting energy expenditure). Vigorous intensity of PA was assumed to be 8 METs; moderate intensity, 4 METs; and walking, 3.3 METs (18).

Statistical analysis

Data obtained were analysed using IBM SPSS (version 22, SPSS Inc., Chicago, IL, USA) and AMOS 20.0. Construct validity of the scale was verified via exploratory and confirmatory factor analyses. The number of factors was determined based on the eigenvalue-greater-than-one rule. Principal component factor analysis was used for factor extraction. Varimax rotation was performed to maintain proper factorisation. Internal consistency of the whole scale, as well as of each subscale, which was formed by factor analysis, was presented with Cronbach's alpha. Item distinctiveness was evaluated by independent samples t-test. The reliability of the scale is presented as test–retest correlation coefficient, and Spearman's correlation coefficient was used. Correlations between the PABS-E and other scales were determined via Spearman's correlation coefficient. We calculated floor and ceiling effects on score distribution. The significance level for all analyses was set at $p<0.05$.

RESULTS

The demographic characteristics are presented in Table 1. Comorbidities included diabetes mellitus (21.5%), hypertension (50.9%), heart disease (23.8%) and others including rheumatic

diseases, vision problems and orthopaedic disorders (52.7%). Only 1.4% reported workplace employment. Individuals' IPAQ score and NHP score with subscores are presented in Table 2.

According to item statistics, there were three items (13, 19 and 28) with item–total correlations of <0.3. Nevertheless, Cronbach's alpha did not decrease when these items were deleted (Table 3).

Item distinctiveness was detected by comparing the lower and upper 27% groups, according to total score. Since all differences were significant, all items were distinctive ($p<0.05$).

Before performing factor analysis, we determined sampling adequacy using the Kaiser–Meier Olkin measure to be 0.8834. Therefore, the sample was adequate for factor analysis. The Bartlett test indicated that the scale was factorable ($p<0.001$).

Based on the factor analysis results, items attending to similar parameters were observed to be clustered around three factors, which explained 84.53% of the variance. The factor clusters and weights are presented in Table 4.

Confirmatory factor analysis was applied by changing the factor of four items (items 15, 8, 27 and 28). Item 15 moved from environmental factors to personal factors. Because in item 15, the PA barrier is 'not feeling good psychologically'. Items 8 and 28 moved from personal factors to environmental factors. In item 8, the PA barrier was 'there are many stairs in the neighbourhood' and it is related to environment. In item 28, health care workers are included in social environment. We moved item 27 from daily routines to environmental factors. Since this item relates to rugged-ramp roads, it was appropriate as an environmental factor. Specifically, we expected a best-fit model with the following indices: a Satorra–Bentler scaled chi-square (S-Bχ2)/ degrees of freedom ratio (CMIN/DF) of ≤2.0; a Trucker Lewis index (TLI) of ≥0.90; a comparative fit index (CFI) of ≥0.90; a goodness-of-fit index (GFI) of ≥0.90; an Incremental Fit Index (IFI) of ≥0.90 and a low Root Mean Square Error of Approximation (RMSEA) of ≤0.08. These values were calculated as CMIN/DF: 1.659, RMSEA: 0.056, GFI: 0.839, IFI: 0.905, CFI: 0.903 and TLI: 0.891. Accordingly, this factor structure was found appropriate: personal factors subscale: 1, 2, 3, 10, 11, 12, 15, 21, 22, 24, 25, 26; environmental factors subscale: 4, 5, 6, 7, 8, 16, 17, 20, 23, 27, 28, 29, 30 and daily routines subscale: 9, 13, 14, 18, 19. Scores from the scale range from 30 to 90. Higher scores indicate more PA barriers. The personal factors subscale can be scored between 12 and 36. The environmental factors subscale can be scored between 13 and 39. The daily routines subscale can be scored between 5 and 15.

The PABS-E is completed in about 5-10 minutes. The mean PABS-E total score was 49.6±14.3. The subscale scores for personal factors, environmental factors and daily routines were 21.6±7.8, 20.9±7.0, 7.1±2.4 respectively. The PABS-E test–retest correlation was 0.869 ($p<0.001$). The test–retest correlation scores for the personal factors, environmental factors and daily routines subscales were 0.833, 0.866 and 0.538, respectively ($p<0.001$).

Cronbach's alpha coefficients for the PABS-E, personal factors, environmental factors and daily routines subscales were 0.918, 0.906, 0.863 and 0.655, respectively. Floor and ceiling effects were acceptable (floor effect: 9.1%; ceiling effect: 0.5%). A statistically significant, negative correlation was found between the PABS-E and IPAQ, and a positive correlation was found between the PABS-E and NHP scores (Table 5).

Table 1. Demographic data (N=214).

Demographic data		**X±sd**	**Min-Max**
Age (years)		73.9±7.7	65–105
Height (cm)		161.1±9.7	110–190
Weight (kg)		72.6±14.2	40–140
Body mass index (kg/m²)		28.1±5.7	14,9–56,1
		N	**%**
Gender	Male	95	44.4
	Female	119	55.6
Life setting	Nursing home/ retirement village	92	43.0
	At home with partner or family	91	42.5
	At home alone	31	14.5
Education level (years)	Literate (<5 years)	52	24.3
	5	86	40.2
	8	18	8.4
	11	33	15.4
	15	21	9.8
	>15	4	1.9
Marital status	Married	74	34.6
	Single	22	10.3
	Widow	118	55.1
The number of people using mobility aid		50	23.4

Table 2. Data on physical activity level and quality of life.

Variable	**X±sd**	**Median**	**Min-Max**
IPAQ[a] score	794.4±1066.9	462	0–8424
NHP[b] score	204.8±154.5	178.0	0–600
Energy level	45.5±40.4	39.2	0–100
Pain	31.3±35.5	12.9	0–100
Emotional reactions	31.2±32.8	19.8	0–100
Social isolation	29.0±31.9	22.0	0–100
Sleep	35.6±31.8	28.7	0–100
Physical activity	32.0±27.1	31.3	0–100

[a] IPAQ: International Physical Activity Questionnaire, [b]NHP: Nottingham Health Profile

Table 3. Item analysis of the physical activity barriers scale for the elderly.

Physical activity barriers	X±sd	Item-Total correlation	Cronbach alpha when item is deleted
Item 1	1.90±0.96	0.561	0.915
Item 2	1.44±0.78	0.448	0.917
Item 3	1.64±0.89	0.595	0.914
Item 4	1.62±0.89	0.576	0.915
Item 5	1.60±0.89	0.493	0.916
Item 6	1.54±0.86	0.477	0.916
Item 7	1.42±0.78	0.484	0.916
Item 8	1.51±0.84	0.483	0.916
Item 9	1.75±0.93	0.340	0.918
Item 10	1.82±0.94	0.634	0.914
Item 11	1.87±0.94	0.615	0.914
Item 12	1.90±0.96	0.665	0.913
Item 13	1.21±0.56	0.200	0.919
Item 14	1.33±0.72	0.311	0.918
Item 15	1.53±0.86	0.520	0.916
Item 16	1.55±0.87	0.501	0.916
Item 17	1.72±0.94	0.552	0.915
Item 18	1.61±0.89	0.394	0.917
Item 19	1.21±0.59	0.115	0.920
Item 20	1.86±0.95	0.556	0.915
Item 21	1.80±0.92	0.517	0.916
Item 22	1.78±0.95	0.452	0.917
Item 23	1.72±0.92	0.552	0.915
Item 24	2.09±0.96	0.611	0.914
Item 25	1.90±0.95	0.661	0.913
Item 26	1.93±0.97	0.629	0.914
Item 27	1.89±0.97	0.561	0.915
Item 28	1.19±0.56	0.149	0.920
Item 29	1.71±0.92	0.589	0.914
Item 30	1.60±0.89	0.455	0.917

Table 4. Results of explanatory factor analysis.

Physical activity barriers	Factor 1	Factor 2	Factor 3
1	0.6731		
2	0.4831		
3	0.6169		
8	0.4174		
10	0.6620		
11	0.7476		
12	0.8146		
21	0.6186		
22	0.4680		
24	0.6433		
25	0.8244		
26	0.8170		
27	0.4392		
4		0.5397	
5		0.6651	
6		0.6508	
7		0.5345	
15		0.4951	
16		0.6180	
17		0.6649	
20		0.4867	
23		0.6187	
29		0.4619	
30		0.5627	
9			0.4780
13			0.5722
14			0.3048
18			0.6219
19			0.5802
28			0.4118
Eigenvalues	8.839	2.446	1.340
Described variance	%59.21	%16.39	%8.98

KMO: 0.8834
Bartlett p: <0.001

Table 5. Correlation of the Physical Activity Barriers Scale for the Elderly with International Physical Activity Questionnaire and Nottingham Health Profile.

	Total Score		Personal Factors		Environmental Factors		Daily routine	
	r	p	r	p	r	p	r	p
IPAQ[a] score	-0.340	<0.001	-0.434	<0.001	-0.252	<0.001	0.069	0.312
NHP[b] score	0.693	<0.001	0.731	<0.001	0.511	<0.001	0.278	<0.001
Energy level	0.644	<0.001	0.685	<0.001	0.446	<0.001	0.294	<0.001
Pain	0.557	<0.001	0.635	<0.001	0.346	<0.001	0.251	<0.001
Emotional Reactions	0.584	<0.001	0.568	<0.001	0.482	<0.001	0.253	<0.001
Social Isolation	0.480	<0.001	0.460	<0.001	0.409	<0.001	0.166	0.015
Sleep	0.441	<0.001	0.418	<0.001	0.379	<0.001	0.205	<0.001
Physical Activity	0.548	<0.001	0.653	<0.001	0.350	<0.001	0.154	0.024

[a]IPAQ: International Physical Activity Questionnaire, [b]NHP: Nottingham Health Profile

DISCUSSION

The PABS-E is a valid and reliable scale that can be used to determine PA barriers in elderly individuals.

The scale appears appropriate for use in elderly individuals with different characteristics because our study cohort included participants of both sexes with different barriers, living environments, education levels and PA levels. Rantakokko et al. examined only environmental barriers, Rasinaho et al. evaluated only older people with mobility limitations, Eronen et al. examined only barriers to outdoor physical activity, Lin et al. examined only older women's physical activity barriers (5,12,19,20). PABS-E is advantageous because it evaluates physical activity barriers multidimensionally and is suitable for elderly people with different characteristics.

Item–total correlations of most items were >0.3, with the exception of items 13, 19 and 28. Because the Cronbach's alpha of these items did not decrease when the items were deleted, and according to the authors who developed the scale, these items should remain because they represent potential important PA barriers in elderly individuals.

The higher scores were taken from item 24 (tiring quickly), item 26 (fear of falling), item 12 (inadequate physical condition) and item 1 (difficulty in walking). These barriers to elderly individuals are frequently reported in the literature (1). The most common barriers were among the personal factors. Similarly, Rasinaho et al. found that the barrier categories pertaining to exercise were poor health, fear, negative experiences, lack of knowledge, lack of time and interest, lack of company and unsuitable environment for elderly individuals with mobility limitations (5).

We performed the test–retest correlation analyses to verify the test–retest reliability of the scale and found the reliability of the PABS-E to be good. Only the daily routines subscale's test–retest correlation was moderate. During test–retest, the respondent may have different perceptions of these

items. Because items on the daily routines subscale contain low intensity PAs (like praying, caring for grandchildren or daily jobs), they may represent activities that require body movements but are inadequate for PA, as proposed by the WHO, which recommends at least 150 min of moderate intensity PA or 75 min vigorous intensity during the week, in sessions lasting at least 10 min for individuals aged ≥65 years (8). We added a description to the items in the daily routines so they could be better understood: "Do these daily activities prevent you from participating in activities such as fast walking, gardening, housework and sports where you would expect to spend at least 150 minutes a week doing moderate intensity activities that increase your heart rate?"

The PABS-E Cronbach's alpha indicates that the internal consistency of the scale is very good. Vasudevan et al. found that the Cronbach's alpha of the Physical Activity Barriers Questionnaire for People with Mobility Impairments was 0.792–0.935 (21). Since the difference between the upper and lower 27% groups and the average of the scores of each item was significant, the distinction of each item has been shown.

A negative correlation between the PA level and PABS-E score is expected. Individuals who have more PA barriers are expected to perform less PA. Similarly, there was a negative relationship between PA barriers and PA levels in other studies (6,22).

We found a positive correlation between QoL and the PABS-E score. In particular, the correlation coefficient between personal factors and NHP score was high. This suggests that excessive PA barriers exert greater effects on QoL. Actions directed at increasing QoL should focus on personal barriers. There was no significant correlation between the IPAQ score and daily routines score. This shows that barriers that concern daily routines may require PA; however, there was a low correlation between daily routines and NHP subscores. The presence of daily routines may therefore prevent adequate PA, while not adversely affecting QoL.

The PABS-E contains 30 questions and it can be completed quickly. Elderly participants were able to successfully use a 3-point Likert-type scale to respond to the PABS-E questions. In addition to assessing the personal and environmental factors that are important in ICF, assessment of daily routines also allows for multidimensional evaluation of PA barriers. It is common for Turkish people to care for their grandchildren and perform low level PAs for worship five times per day. Importantly, the PABS-E enables the evaluation of these cultural habits within the context of daily routines.

One strength of our study was the inclusion of elderly participants with different life settings. The ability to evaluate different societal groups suggests that all elderly individuals can be represented using this tool.

One of the limitations of our study was our inability to include an adequate number of people using wheelchairs. There is a need for more comprehensive studies, including elderly individuals who use wheelchairs, as these individuals may face considerable environmental PA barriers.

Approaches that increase PA are important for reducing morbidity and mortality rates, increasing independence in everyday life and QoL (8, 9). We must determine the factors that impede PA to increase PA in elderly individuals and better understand the effectiveness of interventions that target PA. Although there are semi-structured and qualitative studies that identify PA barriers in elderly individuals, the number of quantitative studies is low (1, 7). The PABS-E is the first measure to assess PA barriers for Turkish elderly individuals, which was developed considering Turkish culture. The findings of this study may serve as a useful tool for developing community-based PA interventions for older adults.

ACKNOWLEDGMENTS

The Authors thank to Çanakkale Municipality Altın Yıllar Senior Club, Çubuk Abidin Yılmaz, Kızılcahamam Akyurt Gicik and Elmadağ Nursing Homes.

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