EXTRA Dementia and Geriatric Cognitive Disorders

Dement Geriatr Cogn Disord Extra 2019;9:319–329
DOI: 10.1159/000501676
Received: June 20, 2019
Accepted: June 21, 2019
Published online: August 29, 2019

Research Article

Psychometric Properties of the Czech Version of the Falls Efficacy Scale-International in Patients with Early-Stage Dementia

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Keywords
Dementia · Older people · Falls Efficacy Scale-International · Validation

Abstract
Introduction: A fear of falling marks an important psychological factor connected with a reduction in the life space of people with dementia. The Czech version of the Falls Efficacy Scale-International (FES-I) has not been validated in patients with early-stage dementia. ***Methods:*** The tests were administered to 282 patients with early-stage dementia. The test battery included the following: the FES-I, the Short Physical Performance Battery, the Geriatric Depression Scale, the Bristol Activity Daily Living Scale, and the Quality of Life-Alzheimer's Disease Scale. Internal reliability (Cronbach's α and intraclass correlation [ICC]), Pearson's and Spearman's correlations, exploratory factor analysis, and a *t* test for independent samples were used for statistical analyses. ***Results:*** The Czech version of the FES-I had excellent internal and test-retest reliability (Cronbach's α = 0.98, ICC = 0.90; 95% CI 0.82–0.94). Factor analysis suggested 2 relevant factors. A significantly higher FES-I score was associated with patients with early-stage dementia who were older (p = 0.003) or female (p = 0.001), lived alone (p = 0.0001), spent >8 h a day alone (p = 0.032), used mobility aids (p < 0.0001), or had severe hearing (p = 0.004) or vision impairment (p < 0.0001) or a lower education (r = –0.16, p = 0.007). ***Conclusion:*** The Czech version of the FES-I had very good reliability and validity and may be useful in future cross-cultural comparisons in research among patients with early-stage dementia.

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Introduction

Dementia ranks among the leading causes of disability in older adults worldwide. Falls are important safety issues for patients with early-stage dementia (PwD) [1]. People with cognitive impairment may be unable to recognize worsening physical function and the risk of falling, and as a result they are less attentive to a fear of falling (FoF) [2]. An FoF has been defined as a lasting concern about falling that causes an individual to avoid activities that he/she remains capable of performing and a loss of self-efficacy to perform some activities without falling [3]. Therefore, an FoF marks an important psychological factor linked to a reduction in the life space of older adults in different cultural and social environments, and the strength of this association is site specific [4].

The most frequent scale for assessing an FoF, which measures different levels of concern about falling, is the Falls Efficacy Scale-International (FES-I). It was developed and validated by the Prevention of Falls Network Europe [5, 6]. Previous studies have shown that the FES-I is a valid and reliable test for assessing an FoF in older adults across cultural environments [7–16]. Validation studies for the FES-I have been carried out in different older patient groups, such as community-dwelling older people [15], users of older people's day centers [17], and hospitalized older adults [18]; however, only a few studies have analyzed the characteristics of persons with cognitive impairment [19].

To date, no psychometric validation of the Czech version of the FES-I has been conducted [20]. Therefore, this study aimed to analyze the psychometric properties of the Czech version of the FES-I (internal consistency, test-retest reliability, and concurrent and convergent validity) in a sample of PwD living in a home environment and to compare the FES-I scores based on select characteristics of the participants (demographic, social, and clinical).

Materials and Methods

This study is a part of the first phase of a longitudinal, multicentric study focusing on the trajectory of the quality of life (QoL) of PwD in the Czech Republic (registered in Clinical Trials.gov; No. NCT02845830). Czech versions of the following standardized tests were used: the FES-I, the Short Physical Performance Battery (SPPB), the Geriatric Depression Scale (GDS-15), the Bristol Activity Daily Living Scale (BADLS-CZ), the Quality of Life-Alzheimer's Disease Scale (QOL-AD), as well as a batch of demographic, social, and clinical characteristics. The test battery for PwD included the FES-I, the SPPB, the GDS-15, and the QOL-AD (patient version). A family caregiver completed the BADLS-CZ and the QOL-AD (caregiver version).

Study Sample

The sample was comprised of community-dwelling PwD and their family caregivers. PwD meeting the following criteria were included: (1) any type of dementia diagnosed within the past 12 months (early stage) [21], (2) age ≥60 years, (3) living at home, (4) having contact with a family caregiver at least once a week, and (5) consenting to be included in the survey.

Measurement Tools

Falls Efficacy Scale-International

The FES-I measures the level of FoF while performing activities of daily living (ADL). The test consisted of 16 items based on the FES (10 original items assessing basic activities and 6 additional items assessing more demanding physical and social activities). Each item was assessed on a 4-point Likert scale from 1 (not at all concerned) to 4 (very concerned). The total score ranges from 16 to 64, with higher scores indicating more concern about falling [5].

Geriatric Depression Scale

The GDS-15 evaluated the presence of depressive complaints and was comprised of 15 items of self-reported measures. The GDS-15 is a reliable and valid self-rating depression screening tool for patients with mild-to-moderate dementia. The overall score ranges from 0 and 15 points [22].

Quality of Life-Alzheimer's Disease Scale

The QOL-AD consists of self and proxy reports of the QoL. All items scored take into consideration the current QoL. Both the patient and the caregiver versions of the test included 13 domains. Each domain was assessed on a 4-point Likert scale from 1 (poor) to 4 (excellent). A higher overall score (between 13 and 52 points) represented a better QoL [23, 24].

Bristol Activity Daily Living Scale

The BADLS-CZ is comprised of elemental and instrumental ADL and encompasses a wide range, from fully independent to fully dependent, which is particularly important for PwD. The test is completed by a family caregiver who assesses the performance of 20 activities in the life of the care recipient. The total score ranges from 0 (fully independent) to 60 points (fully dependent) [25, 26].

Short Physical Performance Battery

The SPPB is designed to measure functional status and physical performance. The SPPB is a composite measure assessing walking speed, standing balance, and sit-to-stand performance. Each SPPB component test (balance and gait) is scored from 0 (not attempted or could not do the test) to 4 (the highest category of performance) [27, 28].

Procedures

Data were collected between May 2016 and June 2017. PwD were recruited from geriatric and neurological outpatient departments of university hospitals in Hradec Králové, Olomouc, and Ostrava in the Czech Republic. After a routine neurological consultation, a physician assessed the cognitive functioning of the PwD, performed an elementary hearing and vision examination, and informed the PwD and their caregivers about this study. A research nurse provided the PwD with the tests and explained how to complete the questionnaires. Sociodemographic and health-related data, including level of education, living arrangement, social life, frequency of social visits, telephone contact with relatives/friends, and the daytime spent alone, were collected during a standardized interview.

Sample Size

The sample size was estimated according to the correlation coefficient between the FES-I and other scales ($\rho = 0.2$), the type I error rate ($\alpha = 0.05$), and power (0.9). The resulting sample size in ideal conditions was calculated to be at least 258 [29]. Given an expected return rate of 70%, we recruited 370 PwD.

Statistical Analysis

The sample was described using absolute and relative frequencies (mean, SD, median, and range). The internal reliability of the FES-I was measured using Cronbach's α. Intraclass correlation (ICC) coefficients were used in the reliability test-retest. The correlation between each item and the overall scale was calculated using Pearson's correlation. The internal structure was tested using an exploratory factor analysis. The principal component method with Varimax rotation was used to establish the number of factors. Convergent validity was verified using the correlation of the FES-I scale with the SPPB, the GDS-15, the BADLS-CZ, and

DOI: 10.1159/000501676

Table 1. Sociodemographic and clinical assessment data

Characteristic	Value
Age	
Mean ± SD	80.0±7.8
Median (range)	80 (60–97)
Gender	
Female	177 (62.8)
Male	105 (37.2)
Education	
Elementary	71 (25.2)
Vocational	94 (33.3)
Secondary	93 (33.0)
Tertiary	24 (8.5)
Living arrangements	
Living alone	100 (35.5)
Other	182 (64.5)
Attending a social event	
30 or more days ago	127 (45.0)
Within the last 30 days	155 (55.0)
Visiting relatives/friends	
7 or more days ago	61 (21.6)
Within the last 7 days	221 (78.4)
Phone call to relatives/friends	
3 or more days ago	126 (44.7)
Within the last 3 days	156 (55.3)
Daytime spent alone, h	
<8	197 (69.9)
≥8	85 (30.1)
Hearing impairment	
None/minimal	243 (83.2)
Moderate/severe	39 (13.8)
Eyesight impairment	
None/minimal	234 (83.0)
Moderate/severe	48 (17.0)
Cognitive function	
MMSE score (0–30)	
Mean ± SD	22.68±1.71
Median (range)	23 (20–25)
Independence	
BADLS-CZ (0–100)	
Mean ± SD	75.30±20.3
Median (range)	81 (2–100)
Physical performance	
SPPB (0–12; total score)	
Mean ± SD	5.9±4.0
Median (range)	7 (0–12)
Use of walking aids	
No	183 (64.9)
Yes	99 (35.1)
Depression	
GSD-15 (0–15; total score)	
Mean ± SD	5.1±4.0
Median (range)	4 (0–15)
QoL	
QOL-AD (13–52; composite score[a])	
Mean ± SD	35.70±4.9
Median (range)	36 (13–49.3)

The total number of patients was 282. Values are presented as numbers (%) unless otherwise stated. [a] A weighted composite score is calculated by multiplying the patient score by 2, adding the caregiver score, and dividing the resulting number by 3.

the QOL-AD scales. A composite scale (weighted score calculated by multiplying the patient's score by 2, adding the caregiver's values, and dividing the sum by 3) was used with the QOL-AD. The correlation was established using Spearman's correlation. A comparison of PwD subgroups according to age, sex, and other characteristics was carried out using a *t* test for independent samples. All tests were conducted at a significance level of 0.05. For statistical processing, IBM SPSS Statistics for Windows (version 23.0; IBM Corp., Armonk, NY, USA) was used.

Results

Participants

A total of 282 PwD (76.2% of the 370 recruited) were included in the survey. The average Mini-Mental Stage Examination score was 22.7 (SD = 1.7). The PwD age ranged from 60–97 years, the mean age was 80.0 years (SD = 7.8), and the majority were female (n = 177; 62.8%). Of the PwD participants, 187 (66.3%) had completed vocational or secondary education and 100 (35.5%) reported living alone. The demographic, social, and clinical characteristics are presented in Table 1.

Reliability

Internal Consistency

The internal consistency (Cronbach's α) of the FES-I was 0.98. The item-total correlation ranged between 0.81 and 0.93, which indicated a strong-to-very strong correlation. When items between 0.978 and 0.979 were deleted (close to the overall α), Cronbach's α indicated that the scale was homogeneous (Table 2).

Test-Retest Reliability

The first 50 PwD who completed the questionnaire were selected for test-retest reliability. The respondents completed the questionnaire again 2 weeks later. PwD were 68–96 years of age and the average age was 84.7 years (SD = 8.4). The ICC for the overall scale was 0.90 (95% CI 0.82–0.94). The ICC values for each item ranged between 0.71 and 0.90, which indicated good-to-excellent reliability (Table 2).

Construct Validity

The sample adequacy for factor analysis was verified using the Kaiser-Meyer-Olkin test (0.96) and Bartlett's test of sphericity ($p < 0.0001$). Based on Kaiser's rule (eigenvalue >1) we selected 2 factors, which explained 83.7% of the overall variability (Table 2).

Convergent Validity

The convergent validity was verified using Spearman's correlation between the FES-I and the SPPB, the GDS-15, the BADLS-CZ, and the QOL-AD (composite score). A moderate-to-strong negative correlation was demonstrated with the SPPB ($r = -0.64$, $p < 0.0001$) and the BADLS-CZ ($r = -0.64$, $p < 0.0001$), a weak negative correlation was determined with the QOL-AD ($r = -0.36$, $p < 0.0001$), and a moderate positive correlation was determined with the GDS-15 ($r = 0.42$, $p < 0.0001$).

A comparison of the overall FES-I score with each subgroup of PwD divided according to demographic social and clinical characteristics using an independent samples *t* test indicated that there was a significantly higher FES-I score (higher FoF) among PwD who were older ($p = 0.003$) or female ($p = 0.001$), lived alone ($p = 0.0001$), spent >8 h a day alone ($p = 0.032$), used mobility aids ($p < 0.0001$), or had more severe hearing impairment ($p = 0.004$) or vision

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Table 2. Internal consistency of the FES-I, test-retest reliability, and factor analysis

FES-I item	Internal consistency (n = 282)			Test-retest reliability (n = 50)					Two-factor solution	
	mean score ± SD	item-total correlation	Cronbach's α if the item is deleted	mean		ICC	95% CI		factor load	
				1st	2nd		lower	upper	factor 1	factor 2
Cleaning the house	1.78±0.99	0.82	0.98	1.96	2.02	0.77	0.630	0.864	0.835	0.357
Getting dressed or undressed	1.58±0.85	0.82	0.98	1.66	1.86	0.81	0.672	0.887	0.825	0.365
Preparing simple meals	1.65±0.93	0.81	0.98	1.74	1.94	0.71	0.546	0.827	0.855	0.326
Taking a bath or shower	1.85±0.97	0.82	0.98	2.00	2.20	0.73	0.575	0.840	0.806	0.381
Going to the shop	1.84±1.07	0.89	0.98	1.96	2.22	0.83	0.698	0.902	0.786	0.490
Getting in or out of a chair	1.68±0.95	0.84	0.98	1.70	1.86	0.79	0.655	0.874	0.767	0.442
Going up or down stairs	2.19±1.09	0.89	0.98	2.32	2.28	0.80	0.658	0.876	0.668	0.606
Walking around outside	1.95±1.14	0.93	0.98	2.08	2.08	0.82	0.709	0.896	0.673	0.657
Reaching up or bending down	1.98±1.09	0.92	0.98	2.04	2.24	0.83	0.714	0.901	0.674	0.644
Answering the telephone	2.04±1.13	0.91	0.98	2.16	2.22	0.84	0.731	0.905	0.619	0.680
Walking on a slippery surface	2.54±1.01	0.84	0.98	2.58	2.58	0.73	0.571	0.839	0.420	0.794
Visiting a friend or relative	1.88±1.12	0.90	0.98	1.96	2.18	0.78	0.641	0.871	0.559	0.732
Walking in a place with crowds	2.07±1,18	0.89	0.98	2.16	2.28	0.90	0.833	0.943	0.483	0.800
Walking on an uneven surface	2.45±1.08	0.84	0.98	2,46	2.52	0.75	0.595	0.849	0.343	0.876
Walking up or down a slope	2.51±1.09	0.81	0.98	2.56	2.56	0.71	0.544	0.827	0.276	0.898
Going out to a social event	1.94±1.15	0.84	0.98	2.08	2.30	0.85	0.746	0.916	0.485	0.734
Total score	32.01±14.81		0.98*	33.42	35.34	0.90	0.826	0.941	N/A	

Table 3. Demographic, social, and clinical characteristics of the PwD and comparison of the FES-I scores in relation to the characteristic variables

Variable	Patients	FES-I score	*p* value
Demographic characteristics			
Age (range 60–97), years			
<75	69 (24.5)	27.88±11.88	0.003[a]
≥75	213 (75.5)	33.35±15.43	
Sex			
Male	105 (37.2)	28.51±13.13	0.001[a]
Female	177 (62.8)	34.08±15.39	
Education		–0.161[b]	0.007
Living arrangement			
Living alone	100 (35.5)	36.70±15.64	0.0001[a]
Other	182 (64.5)	29.43±13.71	
Social participation (frequency of social activities)			
Going out to a social event			
30 or more days ago	127 (45.0)	30.28±14.50	0.075[a]
Within the last 30 days	155 (55.0)	33.43±14.96	
Visiting relatives/friends			
7 or more days ago	61 (21.6)	3.89±15.32	0.265[a]
Within the last 7 days	221 (78.4)	31.49±14.66	
Phone call to relatives/friends			
3 or more days ago	126 (44.7)	35.17±15.66	0.001[a]
Within the last 3 days	156 (55.3)	29.46±13.61	
Daytime spent alone, h			
<8	197 (69.9)	33.25±14.75	0.032[a]
≥8	85 (30.1)	29.13±14.66	
Clinical characteristics			
Use of walking aids			
No	183(64.9)	27.02±12.18	<0.0001[a]
Yes	99 (35.1)	41.24±14.85	
Hearing impairment			
None/minimal	243 (83.2)	31.00±14.34	0.004[a]
Moderate/severe	39 (13.8)	38.31±16.30	
Visual impairment			
None/minimal	234 (83.0)	30.47±14.44	<0.0001[a]
Moderate/severe	48 (17.0)	39.52±14.41	

The total number of patients was 282. Values are presented as means ± SD or numbers (%). [a] Independent samples *t* test; [b] Spearman's correlation coefficient.

impairment ($p < 0.0001$). Spearman's correlation coefficient demonstrated that a lower FES-I score (and, thus, a lower FoF) was reported among PwD with a higher education ($r = -0.16$, $p = 0.007$; Table 3).

Discussion

Our study confirmed the excellent internal consistency of the Czech version of the FES-I (Cronbach's α = 0.98). The Czech version of the FES-I was comparable to the original version (i.e., 0.96) [5], as well as other language versions from different countries, including The Netherlands (i.e., 0.96) [7], Sweden (i.e., 0.95) [30], Italy (i.e., 0.97) [9], Brazil (i.e., 0.93) [8], Turkey

(i.e., 0.93) [10], China (i.e., 0.94) [11], and Iran (i.e., 0.93) [12]. The Czech version of the FES-I was also comparable with the results among geriatric patients with cognitive impairment (i.e., 0.95) [19]. The current findings among PwD also showed excellent test-retest reliability (ICC = 0.90). The ICC was similar to the original FES-I (i.e., 0.96) [5] and the Dutch (i.e., 0.82) [7], Italian (i.e., 0.98) [9], Brazilian (i.e., 0.84) [8], and Greek versions (i.e., 0.95) [16].

With respect to construct validity, there were some different results for the factor analysis in the original version of the FES-I compared to other language adaptations. In our study, factor 2 included items 10–16. Three items listed under factor 2 were the same across cultures (i.e., 11: walking on a slippery surface; 14: walking on an uneven surface; and 15: walking up or down a slope). The common characteristic was ambulation on a difficult/dangerous terrain [5, 8, 10, 11, 15, 30]. For items in factor 2, which were listed solely in our study, the common denominator was social inclusion (i.e., 10: a brisk walk to a ringing phone; 12: visiting friends; and 16: going to a social event). We believe that this difference can be explained by the variation between cultures, levels of physical fitness, and the different levels of social inclusion.

To assess the convergent validity of the Czech version of the FES-I, we compared the instrument with scales assessing physical performance (SPPB), ADL (BADLS-CZ), QoL (QOL-AD), and depression (GDS-15). Positive significant correlations were observed between the FES-I score and the GDS-15. The present results confirmed those of prior studies regarding the relationship between an FoF and depressive symptoms in both community-dwelling older people [6, 11, 13] and users of adult day care centers [17]. Our results showed a moderate positive correlation with the SPPB (includes balance and gait speed tests) with the FES-I score. A significant relationship between the change in SPPB score and the change in FES-I score has also been reported [31]. The relationship between poor balance and a higher FES-I score has been confirmed by other studies, suggesting that those with a higher FoF are less effective in terms of functional mobility and balance. A positive correlation between the FES-I and balance has been confirmed for community-living older persons [10, 11, 12, 16] and cognitively impaired older adults [19].

In our study there was a weak correlation between the FES-I and QoL, which was similar to other studies [6, 11, 12, 30]. In our survey the FES-I score was negatively correlated with the level of independence assessed using the BADLS-CZ. Similar results have been confirmed when assessing independence using the Modified Barthel Index [10] or when using the Instrumental Activities Daily Living Test [11]. The support of independence and physical comfort as a QoL dimension should rank among the most frequently administered nursing interventions [32, 33].

Our research also showed differences in the overall FES-I score when compared to select demographic, social, and clinical characteristics of PwD (Table 3). PwD >75 years of age had a significantly higher FES-I score (greater FoF), which was similar to the Turkish version [10] and a Brazilian study [34]. Women included in the survey reported higher scores on the FES-I compared to men. Such a finding has been noted across cultures, for example in studies carried out in Iran [12], The Netherlands and the UK [7], Greece [16], Turkey [10], China [11], and Australia [6]. The more educated the PwD is, the lower the scores reported on the FES-I in this study are. This result is consistent with a previous study [35]. The results suggested that education plays an important role in managing an FoF in older adults. This study showed a relationship between living alone and higher scores on the FES-I, in agreement with an older study [36]. In contrast, a Brazilian study [34] did not confirm this difference. The reason may lie in cultural factors influencing this relationship and differences in the functional independence and health of the respondents.

In the current study, FES-I scores were significantly higher in PwD who used walking aids. In agreement with the present study, other studies have shown that the use of a walking aid increases the FES-I score [10, 34].

A few limitations must be declared. Firstly, this study was limited to a convenience sample of PwD. It would be desirable to carry out a larger-scale study utilizing a representative, stratified elderly sample not restricted to PwD to provide normative data on FoF issues and to look more closely at the correlations and associations with a wider range of personal, cultural, and fall- and health-related factors. Secondly, the fall history was not investigated in the sample. Thirdly, we did not investigate the symptom duration before the diagnosis was confirmed. Fourthly, we did not evaluate whether the results differ with different types of dementia. Finally, the FES-I was validated only for PwD. It would be helpful for future studies to validate the FES-I against other groups of the elderly population with and without cognitive impairment.

In conclusion, the Czech version of the FES-I had very good psychometric properties in evaluation of the FoF in PwD. This scale had excellent reliability and validity and may be useful in future cross-cultural comparisons in research and clinical trials among PwD.

Acknowledgement

The authors would like to thank the patients and employees of the university hospitals in Hradec Králové and Ostrava for their participation in this study. The authors express their special thanks to Prof. Katherine Froggatt of Lancaster University for her kind support and advice on this research.

Statement of Ethics

The study protocol was approved by the Ethics Committee at the Faculty of Health Sciences at Palacký University Olomouc in the Czech Republic (UPOL-85361/1040-2015). Subjects gave written informed consent.

Disclosure Statement

The authors have no conflict of interests to declare.

Funding Sources

This study was supported by the Ministry of Health of the Czech Republic (grant No. 16-28628A).

Author Contributions

H.K. was responsible for the study design, organization and execution of the research, data analysis and interpretation, and writing and corrections of this paper. D.Š., R.H., K.L., P.K., J.T., and Y.Y. were responsible for data collection, analysis, and interpretation and correction of this paper.

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