
Validation of the Falls Efficacy Scale-International in fall-prone older persons

SIR—Fear of falling in community-dwelling older persons [1, 2] may lead to activity restriction [3]. It can predict future falls [4] and is an important fall-related psychological outcome [5–9]. The widely used 10-item Falls Efficacy Scale (FES) [5] does not evaluate the social dimension of fear of falling and refers almost exclusively to very basic activities of daily living, making it insensitive when used in active older persons. To remedy this, a new 16-item Falls Efficacy Scale-International (FES-I) [10] has been developed by the Prevention of Falls Network Europe (ProFaNE, www.profane.eu.org), showing excellent psychometric properties in a cross-cultural context [11]. Furthermore, a seven-item FES-I has been developed and recommended for use as part of a test battery and for screening purposes [12].

The evaluation of the FES-I has so far been performed in community-dwelling non-clinical samples. To examine the relevance of the two FES-I versions for health care settings, further evaluation of the instrument should include fall-prone older persons.

The aim of this study was to test the psychometric properties of the Norwegian version of the 16-item FES-I in samples of fall-prone older home-dwelling persons recruited from the health care system and to assess if the seven-item FES-I has the same properties as the 16-item FES-I in these samples.

Methods

Eligible older participants (N=672) were recruited from (i) patients in a study on effects of cataract surgery on vision and gait, intervention group and age- and gender-matched controls >70years of age with independent walking function (Vision); (ii) patients referred to a geriatric outpatient falls clinic (Falls clinic); (iii) patients age >70years taking part in a longitudinal observational study on hip fracture, assessed 3 months after surgery (Hip fracture); and (iv) a
mixed group participating in community-based high- and low-intensity exercise groups aimed at preventing functional decline and falls (Community exercise).

For participants initially recruited to research projects (Vision and Hip fracture), participation was approved by the Regional Committee for Ethics in Medical Research in Mid-Norway. The Norwegian Social Science Data Service approved the study for all participants.

The FES-I was administered by self-completion with provision of assistance when needed (Vision, Falls clinic and Community exercise) or as structured interview (Hip fracture).

Translation of the 16-item FES-I into Norwegian followed the translation procedure developed by the ProFaNE (www.profane.eu.org). The FES-I asks about how concerned respondents are about the possibility of falling when performing different everyday life activities. The seven-item FES-I includes items 2, 4, 6, 7, 9, 15 and 16 from the 16-item FES-I [12].

Each item is scored on a four-point scale: 1 = not at all concerned, 2 = somewhat concerned, 3 = fairly concerned and 4 = very concerned. A summary score is calculated by adding the score of each item, giving a scale ranging from 16 to 64 for the 16-item FES-I and from 7 to 28 for the seven-item FES-I. A low score indicates low fear of falling.

Fear of falling was recorded on a yes/no scale for the Vision and the Hip fracture groups and on a four-point scale ‘not at all’, ‘a little’, ‘quite a bit’ and ‘very much’ and afterwards recoded into a yes (‘quite a bit’ and ‘very much’) or no (‘not at all’ and ‘a little’) scale for the Falls clinic and the Community exercise groups. Falls in the previous year (0, 1, ≥2 falls) were recorded for all except for the Hip fracture group, where falls in the last 6 months were recorded. Self-rated general health was reported as: ‘in general would you say your health is 1 = excellent, 2 = very good, 3 = good, 4 = fair or 5 = poor?’ [13].

The internal structure of the FES-I was examined by exploratory factor analysis, using principal component analysis with Varimax rotation and with an oblique rotation to assess inter-item correlation. Based on results from previous studies [10, 11], we used a single-factor and a two-factor solution. Internal consistency was assessed by Cronbach’s alpha and inter-item correlation by Pearson’s r.

One-way ANOVA with post hoc comparisons between groups was used to compare the 16-item and the seven-item FES-I between sub-groups and to test whether FES-I scores were different between predetermined categories: age group (the median age of 80 years was used as cut-off value), gender, fear of falling and falls in the past year. A post hoc Bonferroni test was used to control for multiple comparisons.

Discriminatory validity was assessed by effect size and calculated as the normalised mean score (total score divided by number of items) in the first category subtracted by the normalised mean score in the second category divided by the pooled standard deviation.

## Results

Table 1 shows a sample descriptive for the 563 participants with complete data. FES-I scores were highest for the Falls clinic and lowest for the Vision group, with significant differences in scores between sub-groups ($P<0.035$ for the 16-item FES-I and $P<0.013$ for the seven-item FES-I, respectively).

<table>
<thead>
<tr>
<th>Age (years) Mean (SD)</th>
<th>79.0 (4.8)</th>
<th>79.0 (7.5)</th>
<th>81.5 (5.1)</th>
<th>82.0 (6.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender % female</td>
<td>68.0</td>
<td>81.0</td>
<td>79.5</td>
<td>83.7</td>
</tr>
<tr>
<td>Falls in the past year: % of persons</td>
<td>0</td>
<td>62.0</td>
<td>57.2</td>
<td>11.1</td>
</tr>
<tr>
<td>1</td>
<td>21.9</td>
<td>26.2</td>
<td>20.8</td>
<td>22.8*</td>
</tr>
<tr>
<td>&gt;1</td>
<td>16.1</td>
<td>16.6</td>
<td>68.0</td>
<td>27.9*</td>
</tr>
<tr>
<td>Fear of falling % yes</td>
<td>32.4</td>
<td>44.6</td>
<td>47.9</td>
<td>Data not collected</td>
</tr>
<tr>
<td>Self-rated general health (%)</td>
<td>Excellent 5.4</td>
<td>8.2</td>
<td>5.6</td>
<td>5.3</td>
</tr>
<tr>
<td>Very good 22.6</td>
<td>11.6</td>
<td>4.2</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>Good 38.1</td>
<td>50.0</td>
<td>26.4</td>
<td>41.4</td>
<td></td>
</tr>
<tr>
<td>Fair 27.6</td>
<td>24.7</td>
<td>59.6</td>
<td>30.9</td>
<td></td>
</tr>
<tr>
<td>Poor 6.3</td>
<td>5.5</td>
<td>4.2</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>16-item FES-I: mean (SD)*</td>
<td>26.6 (11.2)</td>
<td>21.0 (6.4)</td>
<td>27.7 (10.5)</td>
<td>36.3 (13.5)</td>
</tr>
<tr>
<td>7-item FES-I: mean (SD)**</td>
<td>11.4 (5.0)</td>
<td>9.1 (3.2)</td>
<td>11.8 (4.6)</td>
<td>15.8 (6.1)</td>
</tr>
</tbody>
</table>

*Falls in the last 6 months.

*P<0.035 between sub-groups.

**P<0.013 between sub-groups.
The seven-item than for the 16-item FES-I (Table 2).

For the seven-item FES-I, Cronbach’s alpha was 0.95 and mean inter-item correlation was 0.54, with correlations ranging from 0.44 to 0.77. The item ‘preparing simple meals’ had the lowest and ‘walking on a slippery surface’ had the highest mean score. Cronbach’s alpha was 0.89 and mean inter-item correlation was 0.54, with correlations ranging from 0.44 to 0.68.

Factor analysis on the 16-item FES-I discriminated two factors with eigenvalues >1, with the first factor dominated by basic and instrumental activities of daily living explaining 35.8% and the second factor dominated by physically demanding outdoor activities explaining 28.9% of the variance (available as supplementary data at Age and Ageing online). Using a single-factor model, it was demonstrated that all items strongly loaded on the same underlying dimension, explaining 75.4% of the variance.

Mean FES-I scores were significantly different between age groups, genders, number of falls in the past year and fear of falling or not (P<0.01), but not for gender for the seven-item FES-I (P=0.068). Effect sizes were slightly lower for the seven-item than for the 16-item FES-I (Table 2).

**Discussion**

The unity of the scale and internal consistency of the 16-item FES-I was good and comparable to what has been reported for previous versions of the scale [11, 12]. Thus, the underlying construct of falls efficacy [14] assessed by the FES-I seems to behave in a similar manner for the different translated versions and samples of older persons.

Our study sample was older, had experienced more falls in the past year and had lower self-rated general health compared with the samples in previous studies [11, 12]. In contrast to previous studies, participants in our study were recruited from the health care system and were at risk of falling. However, interestingly, mean FES-I scores were lower in our sample compared with the English and the Dutch samples, and even somewhat lower than in the German sample that differed from the English and Dutch samples. Thus, differences in scores between countries cannot be explained by health or by fall risk alone. The results indicate that the same score may have a different meaning in different cultures when it comes to fall risk. Another interpretation is that the concept of fear of falling might have different values when translated to different languages. Future studies should highlight if there are also cultural differences in falls prediction by fall efficacy.

Both the 16-item and the seven-item FES-I distinguished between age groups, fear of falling and number of previous falls. Ranking of mean FES-I scores between sub-groups was the same for both scales, but effect sizes were slightly lower for the seven-item FES-I. Our results on the seven-item FES-I are comparable to the previous study [12] and confirm that this shorter scale can be regarded as a feasible alternative to the 16-item FES-I.

A strength of our study is that the sample was heterogeneous and includes persons prone for falling and in contact with the health care system, thus covering different sub-populations for which the FES-I is intended to be applied. This study has limitations in that the seven-item FES-I was derived from the 16-item FES-I, which makes it possible that responses on the rest of the nine items have influenced the seven-item FES-I score. Furthermore, data

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**Table 2.** Mean 16-item and seven-item FES-I scores (SD) according to background variables, with effect sizes for age, gender, falls in the past year and fear of falling

<table>
<thead>
<tr>
<th>Variable</th>
<th>16-item FES-I</th>
<th>7-item FES-I</th>
<th>Effect size 16-item FES-I</th>
<th>Effect size 7-item FES-I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean SD</td>
<td>n</td>
<td>Mean SD</td>
</tr>
<tr>
<td>Age group (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70–79</td>
<td>265</td>
<td>24.7 10.0</td>
<td>10.7 4.6</td>
<td>0.31 0.27</td>
</tr>
<tr>
<td>80+</td>
<td>298</td>
<td>28.7 11.8</td>
<td>12.0 5.2</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>137</td>
<td>24.6 10.7</td>
<td>10.7 4.9</td>
<td>0.24 0.18</td>
</tr>
<tr>
<td>Female</td>
<td>426</td>
<td>27.3 11.2</td>
<td>11.6 5.0</td>
<td>0.36 0.18</td>
</tr>
<tr>
<td>Falls in the past year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>280</td>
<td>23.1 7.7</td>
<td>9.9 3.6</td>
<td>0.41 0.46</td>
</tr>
<tr>
<td>1</td>
<td>134</td>
<td>33.0 13.5</td>
<td>14.1 5.9</td>
<td>0.47 0.46</td>
</tr>
<tr>
<td>&gt;1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fear of fallingc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>179</td>
<td>31.1 12.6</td>
<td>13.3 5.7</td>
<td>0.86 0.78</td>
</tr>
<tr>
<td>No</td>
<td>284</td>
<td>21.9 7.5</td>
<td>9.5 3.6</td>
<td></td>
</tr>
</tbody>
</table>

Note: 

a N=538.

b Effect sizes for falls in the past year are calculated between 0 and 1 falls and between 1 and >1 falls.

c The Hip fracture group is not included in the analyses.

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Research letters
collection for the Hip fracture group was performed by interview, whereas for the others it was based on filling in a questionnaire. However, an earlier study found no differences between these two ways of responding [10].

We conclude that the Norwegian 16-item FES-I has good psychometric properties and that the seven-item version has very similar properties in fall-prone older persons. Data on sensitivity to change are needed in order to determine which version of the FES-I is best suited to measure change following interventions. Compared with previous studies, our results indicate that level of falls efficacy may depend on culture, and this aspect should be highlighted in further studies.

Key points

- The psychometric properties of the Fall Efficacy Scale-International (FES-I) in samples of fall-prone older persons are good.
- The seven-item FES-I has the same psychometric properties and discriminatory power as the original 16-item FES-I.
- Despite lower function, the Norwegian sample scored lower at fear of falling than what is reported in previous studies.

References


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Detection of gait and postures using a miniaturised triaxial accelerometer-based system: Accuracy in community-dwelling older adults

SIR—Ageing is associated with a decrease in physical functioning and mobility [1, 2]. The performance of basic activities of daily living can become progressively difficult [2, 3]. Furthermore, the prevalence of illness increases with advancing age, which may also cause functional limitations. Maintaining physical activity in later life is related to a slower rate of motor decline, less disability and a lower incidence of specific chronic diseases [4–7]. Therefore, accurate knowledge of daily physical activity patterns is essential for assessment and intervention purposes.