Does the falls efficacy scale international version measure fear of falling: a reassessment of internal validity using a factor analytic approach

Harry Hill, Peter McMeekin, Steve W. Parry

The Manchester Centre for Health Economics, Institute of Population Health, University of Manchester, Jean McFarlane Building, Oxford Road, Manchester M13 9PL, UK
Institute of Health and Society, Newcastle University, Baddiley-Clarke Building, Newcastle upon Tyne NE2 4AX, UK
Institute for Ageing and Health, Falls and Syncope Service, Royal Victoria Infirmary, Newcastle upon Tyne NE1 4LP, UK

Address correspondence to: Steve W. Parry. Tel: (+44) 191 282 5893; Fax: (+44) 191 222 5338. Email: steve.parry@nuth.nhs.uk

Abstract

Background: the Falls Efficacy Scale-International (FES-I) is a widely used measure of fear of falling that assesses concerns with respect to falls over a range of physical and social activities. In the original validation study, the methods used (self-selection by participants) were likely to over-represent those with a higher educational level and socio-economic grouping. In addition, the factor analysis method used was potentially less applicable to older individuals and may have been less likely to measure the construct of fear of falling.

Objective: to validate the internal validity of the FES-I and assess its suitability as a measure of fear of falling.

Design: cross-sectional survey.

Setting: community sample.

Methods: a random sample of 200 participants aged 60 years completed the FES-I by structured interview. We verify internal validity with a factor analytic approach not previously employed in this study design context, principal factor analysis on the matrix of polychoric correlations.

Results: we find no redundancy in the questions on the FES-I. All are found to strongly represent concerns about falling during social and physical activities.

Conclusion: the FES-I is an appropriate tool to assess fear or concerns with respect to falls in the general elderly population, and more appropriately represents concern of falling than has previously been found. Future health services research with the FES-I should have its design informed by the results presented in this study, as the structure of the ‘concern with falling’ factor differs markedly from that found in previous validity testing.

Keywords: fear of falling, falls efficacy scale, falls efficacy scale-international, factor analysis, older people

Introduction

Many older individuals, both fallers and non-fallers, suffer from a variety of adverse psychosocial difficulties related to falling including fear, anxiety, loss of confidence and impaired self-efficacy (in this context the self-perception of ability to walk safely without falling) [1–4]. The umbrella term for these problems is ‘fear of falling’, and is found in ~50% of community-dwelling elders who fall, and up to 50% of those who have never fallen [1–3]. Given its impact on wellbeing, increasing dependency and declining mobility, it is of paramount importance to accurately measure fear or concerns with respect to falls in the clinical arena as well as in research that addresses this issue both as a primary and secondary outcome measure.

In recent years, a modification of Tinetti’s original Falls Efficacy Scale [4], the Falls Efficacy Scale-International (FES-I) [5] has been validated in multiple languages and settings, but has yet to be reported in the context of an outcome measure in a falls or fear of falling intervention.
study. Yardley et al.'s original study incorporated factor analysis to enhance the evaluation of the internal validity of the FES-I, but as the authors noted, the methods used (self-selection by participants) were likely to over-represent those with a higher educational level and socio-economic grouping [5]. To assess its utility as both a clinical tool and outcome measure in falls research, we further attempt to verify the internal validity of the FES-I with a more representative sample of older participants and a method of factor analysis that is more appropriate in the study design context.

Methods

Participants

As part of a falls service development initiative between primary and secondary care, we initiated a novel Falls Prevention Service using a general practitioner electronic patient notes-based case-ascertainment approach of patients age 60 years and over in 17 general practices in the North East of England. Patients are invited to attend a multidisciplinary falls service for review, during which they self-complete the FES-I, a 16-item questionnaire assessing fear or concerns with respect to falls. The first 1,000 participants seen at the service in the year following its inception in 2009 comprised the initial study group; 60.5% were female and 39.5% male and with the data presented in Table 1 illustrates adequate representation in this group and variation across age and Index of multiple deprivation (as a proxy for socio-economic background).

There is little consensus on adequate sample sizes in factor analysis, but more recent opinion suggests variable to samples size ratio of 6 is sufficient to support our conclusions [6]. The statistical analysis is based on a random sample of 200 of these anonymised FES-I questionnaires which leaves a ratio of observations to variables of beyond six.

Steps of factor analysis

Factor analysis is a form of summary of the correlation structure between variables. The stages of factor analysis will be outlined, and at each step we will critique and suggest improvements in the manner of factor analysis in the original study [5].

The aim of factor analysis when examining internal structure is often for the identification of a latent component [7]. In the case of the FES-I, this latent component represents fear or concerns with respect to, a concept that cannot be adequately measured by a single survey question. Yardley et al. [5] identify the fear of falling component with the principal components analysis method of factor analysis. We instead apply principle factor analysis which is a preferable method to explore the structure of survey questions when a theoretical basis for imposing a priori design onto factors is absent [8].

The correlation structure of factor items is the foundation of factor analysis. It distinguishes substantive (content-based) similarity from similarities of statistical distributions [9]. Yardley et al. [5] captured correlational structure in a matrix of Pearson’s correlations. This common method of factor analysis erroneously assumes ordinal items to be truncated versions of continuous variables [10]. The factors discovered in this paper are extracted from a matrix of polychoric inter-item correlations which is a method that produces accurate factor results when survey items have ordered categories [11].

We are cautious in deciding the number of factors to extract, applying two methods (Cattell’s Scree test and Horn’s Parallel Analysis) rather than one. These methods are widely used in the literature and are recognised as among the most accurate to determine the number of factors to retain [7, 12].

Results

The comparison of mean scores on items with those in Yardley et al.’s [5] original paper is presented in Table 2. The average item scores from across all the questionnaire items are marginally less than in Yardley et al., 1.006 compared with 1.003, respectively. All but two of the factor items are more highly correlated with the underlying factor than in Yardley et al., while the items ‘Going to the shop’ and ‘Getting dressed/undressed’ in particular have much larger correlations to the factor, by 0.17 and 0.11 in factor loadings, respectively. The average change in the magnitude of factor scores is substantial (0.09) which indicates the questionnaire is a more valid measure of a latent construct of fear of falling than previously thought. Furthermore, there is substantially less variation across the item-loading scores with the overall standard deviation of item scores 42% that found in the Yardley et al.’s paper. This suggests, along with the large-item-loading scores, that the questions are more closely associated with each other and to the underlying factor. In this study, ‘Going out to a social event’ is notably a more important predictor of the underlying fear of falling (the factor) in the questionnaire, while the dominant item with the largest loading is no longer ‘Going up or down stairs’ but ‘Visiting a friend or relative’.

Discussion

Fear of falling is a clinical construct of enormous importance to patients, their take-carers and the wider health economy. Accurate measures of fear of falling are vital in both the clinical arena and in research assessing the usefulness of interventions to improve symptoms. This paper further validates

<table>
<thead>
<tr>
<th>Table 1. Summary of age and index of multiple deprivation of the participants attending the falls service</th>
</tr>
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<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Index of multiple deprivation (deciles)</td>
</tr>
</tbody>
</table>
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Table 2. A comparison of item scores on the extracted single factor solution with Yardley et al. [5]

<table>
<thead>
<tr>
<th>FES-I item</th>
<th>This study</th>
<th>Yardley et al.</th>
<th>Difference in factor solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard deviation</td>
<td>Median</td>
</tr>
<tr>
<td>1. Cleaning the house</td>
<td>1.71</td>
<td>1.00</td>
<td>1</td>
</tr>
<tr>
<td>2. Getting dressed/undressed</td>
<td>1.47</td>
<td>0.79</td>
<td>1</td>
</tr>
<tr>
<td>3. Preparing simple meals</td>
<td>1.38</td>
<td>0.80</td>
<td>1</td>
</tr>
<tr>
<td>4. Taking a bath or shower</td>
<td>1.81</td>
<td>1.03</td>
<td>1</td>
</tr>
<tr>
<td>5. Going to the shop</td>
<td>1.77</td>
<td>0.98</td>
<td>1</td>
</tr>
<tr>
<td>6. Getting in or out of a chair</td>
<td>1.58</td>
<td>0.83</td>
<td>1</td>
</tr>
<tr>
<td>7. Going up or down stairs</td>
<td>2.07</td>
<td>1.10</td>
<td>1</td>
</tr>
<tr>
<td>8. Walking around outside</td>
<td>1.92</td>
<td>1.07</td>
<td>2</td>
</tr>
<tr>
<td>9. Reaching up or bending down</td>
<td>2.17</td>
<td>1.09</td>
<td>2</td>
</tr>
<tr>
<td>10. Answering the telephone</td>
<td>1.62</td>
<td>0.99</td>
<td>2</td>
</tr>
<tr>
<td>11. Walking on a slippery surface &amp; 2.81</td>
<td>1.09</td>
<td>1</td>
<td>0.8627</td>
</tr>
<tr>
<td>12. Visiting a friend /relative &amp; 1.58</td>
<td>0.95</td>
<td>3</td>
<td>0.9199</td>
</tr>
<tr>
<td>13. Going to a place with crowds &amp; 2.00</td>
<td>1.15</td>
<td>1</td>
<td>0.8705</td>
</tr>
<tr>
<td>14. Walking on an uneven surface &amp; 2.66</td>
<td>1.08</td>
<td>2</td>
<td>0.8680</td>
</tr>
<tr>
<td>15. Walking up or down a slope &amp; 2.26</td>
<td>1.09</td>
<td>3</td>
<td>0.8724</td>
</tr>
<tr>
<td>16. Going out to a social event &amp; 1.67</td>
<td>1.00</td>
<td>2</td>
<td>0.8973</td>
</tr>
<tr>
<td>Standard deviation across all items</td>
<td>0.41</td>
<td>0.024</td>
<td></td>
</tr>
</tbody>
</table>

Average difference in factor solution in absolute terms 0.09

the FES-I questionnaire using more rigorous methodology than previous studies. This study also enhances the methods pursued in Yardley et al. by selecting survey respondents with characteristics representative of the general population likely to fall. In addition, it enhances the analytic method by performing a form of explanatory factor analysis on a matrix of polychoric inter-item correlations and investigating the number of factors to retain through testing. The results suggest much stronger internal validity than previously discovered. All items on the questionnaire are highly relevant to the single underlying factor representing concern with falling, and no single item dominates to a large extent the relevance of other items in their association with the factor.

The improved validation of factor constructs [13] discovered is of benefit to future research that is interesting in predicting or explaining fear of falling with the FES-I. First, regression research may want to replace the use of all survey questions with a single ‘representative’ variable from the FES-I, particularly when strong statistical correlations between item responses is the cause of multicollinearity in the model being used [8]. This single variable found would be the most appropriate choice as it represents the attributes of the questions that are related to each other. Second, in the allocation of care services, there may be benefits to identifying the activities which are of most concern to those vulnerable to falls since fear of falling has been found to cause significant losses in health-related quality of life [14]. These would be the FES-I questions which have the highest loadings onto the common factor found. Third, researchers may wish to identify, cluster and place individuals into categories depending on the more accurate factor scores found in the FES-I. For example, this may help to differentiate individuals with a strong fear of falling or to detect changes in concern with falling over time.

Finally, there are stronger grounds for interpreting and labeling the single factor in the FES-I as factor loadings have been calculated with less statistical bias [8].

The results suggest much stronger internal validity than previously discovered, with items on the questionnaire being highly relevant to the single underlying factor representing fear of falling. No single item dominates to a large extent the relevance of other items in their association with the factor. Methodological developments in factor analysis have allowed us the opportunity to reappraise the FES-I with the results reinforcing its worth in measuring a single factor, fear of falling. This opens the door to the potential use of the FES-I as the basis for a tool for directly attaching utility values to levels of fear of falling, allowing its effect on health-related quality of life to be estimated directly.

**Key points**

- The FES-I has not been adequately verified.
- Current inferences based on the comparison of FES-I scores in different populations might be flawed.
- Future health services research with the FES-I should have its design informed by the results presented in this study.
- The structure of the ‘concern with falling’ factor differs markedly from that found in previous validity testing.

**Conflicts of interest**

None declared.
Current prevalence of dementia, depression and behavioural problems in the older adult care home sector: the South East London Care Home Survey

ROBERT STEWART1, MATTHEW HOTOPF1, MICHAEL DEWEY2, CLIVE BALLARD3, JATINDER BISLA1, MARIA CALEM1, VIOLA FAHMY4, JO HOCKLEY5, JULIE KINLEY2, HYWEL PEARCE1, ANoop SARAF4, AYSHA BEGUM2

1Psychological Medicine, King’s College London (Institute of Psychiatry), London, UK
2Health Service and Population Research Department, King’s College London (Institute of Psychiatry), London, UK
3King’s College London, Guys Campus, London, UK
4South London and Maudsley NHS Foundation Trust, MHOA&D CAG, London, UK
5Care Home Project Team, St Christopher’s Hospice, London, UK

Address correspondence to: Aysha Begum. Tel: +44 207 848 0240. Email: aysha.begum@kcl.ac.uk

Abstract

Background: a large and increasing number of older people in the UK are living in care homes. Dementia is a frequent reason underlying admission and determining care needs, but prevalence data are becoming increasingly outdated and reliant on brief screening instruments.

Objective: to describe the prevalence and severity of dementia, depression, behavioural problems and relevant medication use

References

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