



LUND UNIVERSITY

Content Analysis of Four Fear of Falling Rating Scales by Linking to the International Classification of Functioning, Disability and Health.

Jonasson, Stina; Nilsson, Maria H; Carlsson, Gunilla; Lexell, Jan

Published in:
PM&R

DOI:
[10.1016/j.pmrj.2013.01.006](https://doi.org/10.1016/j.pmrj.2013.01.006)

2013

[Link to publication](#)

Citation for published version (APA):

Jonasson, S., Nilsson, M. H., Carlsson, G., & Lexell, J. (2013). Content Analysis of Four Fear of Falling Rating Scales by Linking to the International Classification of Functioning, Disability and Health. *PM&R*, 5(7), 573-582. <https://doi.org/10.1016/j.pmrj.2013.01.006>

Total number of authors:
4

General rights

Unless other specific re-use rights are stated the following general rights apply:
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: <https://creativecommons.org/licenses/>

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

LUND UNIVERSITY

PO Box 117
221 00 Lund
+46 46-222 00 00

Content Analysis of Four Fear of Falling Rating Scales by Linking to the International Classification of Functioning, Disability and Health

Stina Bladh, RPT, MSc^{1,2}, Maria H Nilsson, RPT, PhD¹, Gunilla Carlsson, ROT, PhD¹,
Jan Lexell, MD, PhD^{1,2}

¹ Department of Health Sciences, Lund University, Lund, Sweden

³ Department of Rehabilitation Medicine, Skåne University Hospital, Lund, Sweden

Funding sources: This study was funded by the Faculty of Medicine at Lund University, Lund, Sweden, and the Swedish Council for Working Life and Social Research.

Key words: Disability Evaluation; Outcome Assessment; Rehabilitation; Research Design; Self Efficacy

Corresponding author:

Stina Bladh

Department of Health Sciences

PO Box 157

Lund University

SE-221 00 Lund

Sweden

Phone: +46 46 222 1817

Fax: +46 46 222 1959

E-mail: Stina.Bladh@med.lu.se

ABSTRACT

Objective: To gain a deeper understanding of the content of 4 fear of falling (FOF) rating scales by linking them to the International Classification of Functioning, Disability and Health (ICF).

Design: Linking study according to the ICF linking rules.

Setting: Not applicable.

Patients: Not applicable.

Methods: The rating scales were the Falls Efficacy Scale-International (FES-I), the Swedish version of the Falls Efficacy Scale (FES[S]), the Activities-specific Balance Confidence Scale (ABC), and the modified Survey of Activities and Fear of Falling in the Elderly (SAFFE).

The process followed the established and updated linking rules. Three linkers independently identified all meaningful concepts in the rating scales and linked them to the most precise ICF categories. The linkers then discussed their results in order to reach consensus. If consensus was not attained, the linkers pursued the discussions with a fourth person to reach consensus.

Main outcome measurements: Not applicable.

Results: Most meaningful concepts from the overall questions were linked to the ICF component of body functions. Of the 62 items, all but one meaningful concept were linked to the component of activities and participation. All 4 rating scales covered the chapters of mobility and domestic life and had most linkages to the mobility chapter.

Conclusions: The linking process revealed similarities and differences between the 4 FOF rating scales, as well as methodological challenges in linking instruments to the ICF. By providing a content description that allows for a direct comparison of the rating scales, the results may be helpful when choosing an appropriate rating scale assessing FOF in clinical practice and research. A further head-to-head comparison through psychometric analyses is required to recommend appropriate FOF rating scales. Studies are also needed to investigate how the overall question and response categories of a rating scale affect respondents' answers.

INTRODUCTION

Fear of falling (FOF) is common among older people and in people with mobility difficulties [1-6]. Many older people are afraid of falling and hurting themselves, and this fear is more common than the fear of being robbed or of experiencing financial problems [7]. The consequences of FOF include increased risk of falls, loss of functional independence, depression, and decreased quality of life [1]. The authors of a recent study found that balance confidence was independently associated with activity and participation after stroke, unlike the capacity to walk [8]. Taken together, FOF is an important target in rehabilitation.

FOF can be conceptualized as either decreased balance confidence, activity avoidance because of the risk of falling, low fall-related self-efficacy, or a lasting concern about falling [6,9-11]. A variety of rating scales assess different aspects of FOF, such as the Falls Efficacy Scale (FES) [10], Falls Efficacy Scale-International (FES-I) [12], the Swedish version of the Falls Efficacy Scale (FES[S]) [13], the Activities-specific Balance Confidence Scale (ABC) [9] and the modified Survey of Activities and Fear of Falling in the Elderly (SAFFE) [6]. Although these rating scales may seem similar, it has been argued that they do not assess the same aspect of FOF [2,14]. One way to increase the conceptual understanding of rating scales is by linking them to the International Classification of Functioning, Disability and Health (ICF) [15-17]. Linking is a way of mapping the content covered by a scale and results in a structured description of the scale [17-20].

The ICF offers detailed definitions of different aspects of functioning, disability, and health that are described in a large number of categories [15]. It offers a structure and a common language for describing disability and health that enable a better understanding across different professions and facilitates international and cross-cultural comparisons of health and health-related states [15].

Rules have been developed and updated to enable and standardize linking of rating scales to the ICF [16,17]. Linking is a rigorous method of analyzing rating scales and should be considered a complement to psychometric evaluations. It provides a way of exploring content validity of a rating scale [17,18]. A head-to-head comparison of several linked FOF rating scales may facilitate a direct comparison of contents covered by each scale in the overall questions, items and response categories [17-19]. Together with psychometric studies, this comparison may facilitate the process of choosing appropriate rating scales for assessing FOF in clinical practice and research [17,18]. To the best of our knowledge, no study has rigorously linked commonly used FOF rating scales to the most precise ICF categories. The

aim of this study was to gain a deeper understanding of the content of 4 FOF rating scales by linking them to the ICF.

METHODS

Choice of FOF Rating Scales

The included FOF rating scales were the FES-I, FES(S), ABC and SAFFE. We had several reasons for choosing these rating scales. FES-I was included because it is developed and recommended by the Prevention of Falls Network Europe [12]. It was developed by combining and modifying items from the FES, the ABC and the Survey of Activities and Fear of Falling in the Elderly (SAFE) [12], and we therefore also wanted to include these scales. However, FES [10] is not available in Swedish; therefore, the FES(S) [13] (modification of FES) was instead included. Because SAFE [21] is extensive and complicated, we instead included the modified version (SAFFE) [6]. Our aim was also to include rating scales that assesses various FOF aspects. FES-I and FES(S) relate to concern and confidence in relation to falls, respectively, whereas ABC relates to losing balance and becoming unsteady, and SAFFE to activity avoidance because of the risk of falling [6,9,12,13].

For each of the 4 FOF rating scales, Swedish-translated and Swedish-adapted versions were used. Because of linguistic and cultural differences between the English and the Swedish language, the versions used are not literal translations and have minor differences.

Descriptions of the 4 FOF Rating Scales

FES-I assesses concerns about falling [12]. The respondents answer the overall question of how concerned they are about the possibility of falling in relation to 16 activities (items). The response categories are “not at all”, “somewhat”, “fairly”, or “very concerned”. The total score ranges from 16 to 64 (higher = worse). FES-I is intended to be applicable internationally and in different cultural settings [12]. FES-I has been used in studies, for instance, with older people, people who have had a stroke, and older people after they sustain a hip fracture [22-25]. It has been translated to Swedish by Nordell et al [26].

FES(S) assesses fall-related self-efficacy [13]. Respondents answer the overall question of how confident they are in performing 13 different activities (items) without falling. Response categories range from 0 (not confident at all) to 10 (completely confident), and the total score ranges from 0 to 130 (higher = better) [13]. FES(S) was originally

developed for people who have had a stroke, but it also has been used for people with Parkinson disease and late effects of polio [2,27,28].

ABC assesses balance confidence [9]. Respondents answer the overall question of how confident they are in performing 16 different activities (items) without losing their balance or becoming unsteady. Response categories range from 0% (no confidence) to 100% (completely confident). The total score is the mean value of the 16 items; that is, it ranges from 0% to 100% (higher = better) [9]. ABC has been used in studies with older people, people who have had a stroke, and people with hip osteoarthritis [8,29,30]. The Swedish-translated version of ABC has been culturally adapted, and items related to “stepping onto or off escalators” are changed into “travel by bus” (L. Lundin-Olsson, written personal communication, June 20, 2012).

SAFFE assesses activity avoidance as a result of the risk of falling [6]. Respondents answer the overall question of whether they avoid 17 different activities (items) because of a risk of falling. The response categories are “never”, “sometimes”, or “always” avoid. The total score ranges from 17 to 51 (higher = worse) [6]. SAFFE has been used in studies with older people, older people after sustaining a hip fracture, and in people with Parkinson disease [2,23,25,31]. It has been translated to Swedish by L. Lundin-Olsson (written personal communication, June 20, 2012).

International Classification of Functioning, Disability and Health (ICF)

The ICF is a hierarchically structured classification of functioning, disability and health. The 4 ICF components (body functions, body structures, activity and participation, and environmental factors) consist of 1454 categories that are hierarchically organized in chapters and levels. All categories are defined and assigned a unique code consisting of a letter followed by digits. The letter represents the ICF component (b, body function; s, body structure; d, activity and participation; and e, environmental factor). The first digit represents the chapter level, the following 2 digits represent the second level and the fourth digit represents the third ICF level [15]. The following example illustrates the branched structure of the ICF:

- “d Activities and participation” (component level)
- “d4 Mobility” (first/chapter level)
- “d450 Walking” (second level)
- “d4502 Walking on different surfaces” (third level)

Linking Process

The linking process followed the updated linking rules [17] and was performed by 2 researchers (M.H.N., a physiotherapist and G.C., an occupational therapist) and 1 PhD student (S.B., a physiotherapist). All linkers had 5 to 10 years' experience with the ICF, and the 2 researchers had previously linked rating scales to the ICF [32]. Before linking, all 3 linkers renewed their knowledge by studying the ICF and the updated linking rules [15,17].

According to the linking rules, one item may consist of multiple meaningful concepts, and all concepts are to be linked to the most precise ICF category. The same ICF category may be used several times for linking multiple meaningful concepts within an item. Content of a meaningful concept that is not explicitly named in the corresponding ICF category is documented as "additional information" [17].

Initially, all meaningful concepts of the overall questions, items, and response categories in the 4 FOF rating scales (FES-I, FES(S), ABC, and SAFFE) were identified and linked to the most precise ICF categories [17]. This task was performed individually and independently by the 3 linkers, who thereafter discussed their results to reach a consensus [18,19]. The first consensus meeting covered the items of FES-I and FES(S), and the second meeting covered the items of ABC and SAFFE. A third meeting included discussions regarding environmental factors, although this aspect is not covered in the present study. A fourth meeting covered all overall questions and response categories. A fifth and final meeting covered meaningful concepts in which consensus was not previously reached because of different opinions between the 3 linkers. During this meeting, the linkers pursued the discussions with a fourth person (J.L., a rehabilitation medicine specialist with previous experience of linking rating scales to the ICF [33]) to reach consensus. This process was in agreement with previous linking studies [18,19]. The discussions during all consensus meetings were tape recorded for possible use at a later point.

Analyses

Following the example of Geyh et al [19], content density, content diversity, and bandwidth of content coverage for each linked FOF rating scale are reported to enable a quantitative comparison. Content density is the number of identified meaningful concepts divided by the number of items. A higher value reflects more meaningful concepts per item. Content diversity is the number of unique ICF categories linked divided by the number of identified meaningful concepts. A value of 1 means that each meaningful concept is linked to different

categories, which implies that the content of the rating scale is highly diverse. Bandwidth of content coverage is the percentage used ICF categories of the total number of plausible categories (ie, 1454) and reflects the spread of the content of the rating scale [19]. Depending on the nature of the rating scale and the aim of the assessment, high content density, content diversity, and bandwidth of content coverage of a scale can be either positive or negative [34] (note the second paragraph of the Discussion section). The linking of the overall questions and the response categories in the 4 rating scales is not included in the quantitative comparison but is reported separately (see Table 1).

RESULTS

A total of 13 meaningful concepts from the overall questions and response categories and 101 meaningful concepts from the 62 items of the 4 FOF rating scales were identified. Nine of a total of 114 meaningful concepts (8%) required further discussions with the fourth person to decide on the appropriate corresponding ICF category. Five of these meaningful concepts were in ABC, 3 were in FES(S) and 1 was in FES-I. Four of these concepts contained the word “confident/confidence”. Discussions focused whether this should be linked to a personal factor or body function. The remaining 5 disagreements were spread among items in FES-I, FES(S), and ABC. These items dealt with aspects of walking and moving around in different locations. All but 3 of the total number of meaningful concepts could be linked to the ICF.

Table 1 presents the linking results of the overall questions and response categories of the 4 rating scales. Eight meaningful concepts were linked to the component of body functions and 2 concepts were linked to the component of activities and participation. The overall question in FES-I, FES(S), and SAFFE contained the meaningful concept “falling”. Because falling cannot be linked to an ICF category, these 3 meaningful concepts were assigned the code “nd”, that is, not definable.

Table 2 illustrates the spread of item contents of the 4 FOF rating scales. All but one meaningful concept of the 62 items were linked to the component of activities and participation. One single meaningful concept (from ABC) was linked to the environmental component. Three of 9 chapters of the component of activity and participation were not covered by any rating scale. Two chapters were covered by all 4 rating scales: the chapters of mobility and domestic life. All 4 rating scales, particularly ABC, revealed strongest connections to the chapter of mobility. (See Supplementary Table 1 for a detailed content comparison of items of the 4 FOF rating scales.)

Table 3 presents the quantitative summary of the linking of items and reveals general similarities between the 4 rating scales. Content density was somewhat higher for FES-I (2.1 compared with 1.3 to 1.7 for the other rating scales), which implies that FES-I contained the most meaningful concepts per item. Content diversity was equally low (0.5) for FES-I and ABC, although because of different reasons. In FES-I, multiple meaningful concepts *within* items were often (in 50% of items) linked to the same ICF category. This occurred in 19% of items in ABC. However, meaningful concepts in *different* ABC items were often linked to the same ICF category; for example, 4 items were linked to the category “Reaching”. Table 3 further reveals that SAFFE had the lowest content density (1.3) but the highest content diversity (0.8). This finding mirrors its shortly phrased items that cover diverse aspects of activities and participation. Bandwidth of content coverage ranged from 0.9% (ABC) to 1.2% (FES-I and SAFFE), which means that about 1% of all ICF categories were used to link the items in each FOF rating scale. Tables 4-7 address the actual results of the linking of the 62 items of the 4 rating scales.

DISCUSSION

Linking rating scales to the ICF is a rigorous and established method for analyzing and comparing contents [17-20]. Together with psychometric studies, the linking results may facilitate the selection of appropriate rating scales for assessing FOF in clinical practice and research [17]. To the best of our knowledge, this study is the first that simultaneously links several FOF rating scales to the ICF, which allows for a head-to-head comparison. ABC is the only FOF rating scale that has previously been linked to the ICF [35]. Meaningful concepts were then linked to the second level ICF categories instead of to the most precise categories [17]. In this study, we have linked 4 FOF rating scales to the most precise ICF categories. Most meaningful concepts from the overall questions and response categories were linked to the ICF component of body functions. Of the 62 items, all but one meaningful concept were linked to the component of activities and participation. All 4 rating scales covered the chapters of mobility and domestic life and had most linkages to the chapter of mobility.

Interpretation of Quantitative Measures of the Linking Process

Quantitative measures (eg, content density) were used in accordance with Geyh et al [19], but information on how to interpret such results is limited. Our understanding is that the interpretation depends on the nature of the rating scales. As stated by Gradinger et al [34], a high content density of a rating scale can be both positive and negative. Scales with low content density are suggested to be suitable for clinical settings because their items are less complex [34]. High content density indicates that single items contain multiple meaningful concepts (in the present study: multiple activities). This situation could cause difficulties when interpreting a response because we do not know whether it refers to one or all activities within an item. For example, FES(S) and ABC contain the item “Walk up or down stairs”. However, it has been shown that confidence may be rated differently for walking up stairs compared with down stairs [9]. On the other hand, having multiple meaningful concepts per item may be valuable because it could provide a more detailed and precise instruction to the respondent. For example, the item “Stand on your tiptoes and reach for something above your head” (ABC) illustrates a well-defined and complex situation. Taken together, these examples suggest that there is no rule of thumb for interpretation of content density, which requires careful considerations. Gradinger et al [34] suggest that rating scales with high content density can be combined with scales with low content density to provide a broader spread of assessment.

The bandwidth of content coverage was rather low for all 4 FOF rating scales. All but one meaningful concept of the 62 items were linked to the component of activities and participation, and all rating scales had the majority of linkages to the chapter of mobility. In previous studies, authors have identified walking difficulties as an important contributing factor to FOF [27,36], and walking difficulties increase the risk of restricting outdoor activities because of FOF [37]. Furthermore, FOF is associated with falls [2,5,7,12,21,27], and falls among older people commonly occur during walking (44-57%) [38-40]. Seven of 16 items in ABC, 6 of 17 items in SAFFE, and 5 of 16 items in FES-I are in fact walking related (ie, contain the word “walk/walking” and/or were linked to the ICF category “d450: Walking” or any of its subcategories). In FES(S), 1 of 13 items is walking related.

In all 4 FOF rating scales, there was only a single linkage to the ICF component of environmental factors (see Tables 1-2). Although several items related to the surrounding environment, this did not constitute a meaningful concept by itself. Therefore environmental

factors ended up as “additional information” (see Tables 4-7). This finding highlights the need for taking additional information into account when interpreting linking results.

Does the Linking Capture the Meaning of a Person’s Response to a Rating Scale?

A reasonable assumption is that a person’s response to a rating scale is a function of the overall question, the item, and the response categories, which implies that there may be a difference in the meaning of a person’s responses to 2 identical items if the overall questions differ. Previous studies underline that FOF rating scales do not assess the same aspects of FOF [2,14]. For example, there is a difference in being “concerned about the possibility of falling” (FES-I) compared with “activity avoidance due to the risk of falling” (SAFFE). “Being concerned” expresses a feeling, whereas “avoiding” is a consequence of a perceived risk. In this study, the overall questions in FES-I and SAFFE were in fact linked to different ICF components (b: body functions and d: activities and participation, respectively). In addition, the overall questions differ in that FES-I, FES(S), and SAFFE relate to actual falling, whereas ABC relates to losing balance and becoming unsteady. “Losing balance” and “becoming unsteady” were linked to the component of body functions, whereas “falling” is not included in the ICF.

Difficulties in capturing the meaning of a person’s response also can be a consequence of how the item is phrased. The linkages reflect activities explicitly expressed, even though respondents may interpret the items differently. If a respondent answers that he/she sometimes avoids taking a bath because of a risk of falling (SAFFE), the perceived risk of falling is probably not when sitting in the bathtub but rather when stepping in or out of the tub. The present linking rules do not take into account the intertwined complexity of a rating scale’s overall question, items, and response categories.

Is the Complexity of Items Reflected in the Linking?

The level of difficulty of items is sometimes expressed in terms of positions and directions, such as “Stand on a chair and reach for something” (ABC). This item contains 2 meaningful concepts that were linked to the ICF categories “Maintaining a standing position” and “Reaching”. The words “on a chair” greatly affect the difficulty level but are only reported as “additional information”. This example further highlights the need to take additional information into account when interpreting linking results.

The complexity within an item also may be the combination of two meaningful concepts, for example, “Hurrying up to answer the telephone” (FES[S]). Simply answering the telephone might not be that difficult, whereas hurrying up can be hazardous. For example, people with Parkinson disease often experience freezing of gait in stressful situations that may provoke a fall [41]. If all meaningful concepts within an item (including “additional information”) are not considered simultaneously, item complexity may be lost.

Choosing an FOF Rating Scale

Which FOF rating scale is the most suitable depends on the situation and the target population. The choice must also depend on the rating scales’ psychometric properties such as validity and reliability, which are sample-dependent issues [42]. FES-I, FES(S), ABC, and SAFFE have undergone psychometric evaluation [2,6,9,12-14,23,26], but a head-to-head comparison of all 4 rating scales has not been conducted.

When choosing an FOF rating scale, it is important to consider what aspect one wishes to address or whether one wants to capture the diversity. In this study, all 4 rating scales predominately focused on mobility (d4) and included domestic life (d6), but some differences were found. That is, if one aims at targeting FOF in relation to activities concerning community, social, or civic life (d9), our results clearly favor FES-I or SAFFE. On the other hand, if one wants to have a very strong focus on mobility (d4), ABC might be the choice, because 21 of 24 linkings were within the mobility chapter. However, ABC did not at all include self-care (d5), which was covered by the other 3 rating scales. To evaluate rehabilitation programs that target gait problems to reduce FOF, either FES-I, SAFFE, or ABC is preferred, because these rating scales contain 5 to 7 walking-related items each.

Other considerations must be taken into account beyond coverage and psychometric properties. Although FES-I covers a range of different aspects of activities and participation, several items contain multiple activities, which causes problems when interpreting the respondents’ answers. SAFFE offers items with a good range of diverse content but contains less detailed descriptions of the activities compared with ABC. It needs to be emphasized that the overall question in SAFFE differs from the other rating scales because it asks about activity avoidance rather than confidence or concerns. This difference might limit a head-to-head comparison because these scales assess similar but not interchangeable aspects of FOF [2,14]. Further studies are needed to investigate how the overall question and response categories affect respondents’ answers.

Challenges and Future Perspectives

A great variety of FOF rating scales exist [14]. We have linked only 4 of them, and thus this study is not fully comprehensive. Use of the Swedish translations of the rating scales naturally implies that some linguistic and cultural adaptations have been made. Consequently, linking the English FOF rating scales would not yield the exact results as in this study. However, for the most part the linking would probably be similar, and we therefore believe that our results are applicable to the corresponding English versions.

Future methodological studies are needed that address whether and how the linking rules can take into account the complexity of an item, as well as how the linking results should be presented and interpreted. Furthermore, the ICF does not fully capture all meaningful concepts. Although balance is multifactorial by nature [43], it is only reflected in relation to vestibular function of balance (b2351) and involuntary movement reaction functions (b755) in the ICF. Sensation of falling is classified (b2402), whereas actual falling is not classified [15]. Future revisions of the ICF may benefit from including a more thorough classification of balance and falls.

The predefined activities in the 4 FOF rating scales may not reflect all activities of importance to FOF. The development of ABC included older people, who were asked to name daily activities in which they experienced FOF [9]. Only clinicians and researchers were included in the development of FES and SAFE [10,21]. The end user perspective is important in relation to outcome measures [44], yet few qualitative studies do in fact target FOF in older people. Faes et al [45] interviewed 10 older persons, who all described a fear of being alone in case they might fall, which is an example of an aspect that is not included in any of the 4 rating scales. Another qualitative study [46] reports FOF and activity avoidance in relation to exercising and overall leaving the home. All 4 FOF rating scales include activities that require leaving home, whereas exercising is not contained in any of the rating scales. Further in-depth studies that target FOF are warranted to gain an increased knowledge about how FOF is expressed and perceived but also to explore important activities and aspects, including environmental factors.

CONCLUSION

The choice of rating scale depends on several factors, such as the aim of the assessment, the target population, and the psychometric properties of the scale. The linking process solely provides information about scale content in relation to the ICF, and it revealed advantages and

disadvantages in each of the 4 FOF rating scales. Our results facilitate an increased conceptual understanding of these 4 FOF rating scales, which may assist in the process of choosing an appropriate scale in clinical practice and research. Taken together, the knowledge gained from the linking analysis presented here may be useful when interpreting results of other linking studies and for future revision of the linking rules. Furthermore, the findings may prove useful when revising and developing FOF rating scales, as well as for increasing the understanding of barriers when linking rating scales to the ICF. Finally, the linking revealed some shortages in the ICF. Future revisions of the ICF may benefit from including a more thorough classification of balance and falls.

ACKNOWLEDGEMENTS

The study was accomplished within the Strategic Research Area MultiPark and the Centre for Ageing and Supportive Environments (CASE) at Lund University, Lund, Sweden. M.H. Nilsson is affiliated to the Swedish Parkinson Academy.

REFERENCES

1. Scheffer AC, Schuurmans MJ, van Dijk N, van der Hooft T, de Rooij SE. Fear of falling: measurement strategy, prevalence, risk factors and consequences among older persons. *Age Ageing* 2008; 37:19-24.
2. Nilsson MH, Drake AM, Hagell P. Assessment of fall-related self-efficacy and activity avoidance in people with Parkinson's disease. *BMC Geriatr* 2010; 10:78.
3. Bloem BR, Grimbergen YA, Cramer M, Willemsen M, Zwinderman AH. Prospective assessment of falls in Parkinson's disease. *J Neurol* 2001; 248:950-958.
4. Schmid AA, Van Puymbroeck M, Knies K, et al. Fear of falling among people who have sustained a stroke: a 6-month longitudinal pilot study. *Am J Occup Ther* 2011; 65:125-132.
5. Miller WC, Speechley M, Deathe B. The prevalence and risk factors of falling and fear of falling among lower extremity amputees. *Arch Phys Med Rehabil* 2001; 82:1031-1037.
6. Yardley L, Smith H. A prospective study of the relationship between feared consequences of falling and avoidance of activity in community-living older people. *Gerontologist* 2002; 42:17-23.
7. Howland J, Peterson EW, Levin WC, Fried L, Pordon D, Bak S. Fear of falling among the community-dwelling elderly. *J Aging Health* 1993; 5:229-243.
8. Schmid AA, Van Puymbroeck M, Altenburger PA, et al. Balance and balance self-efficacy are associated with activity and participation after stroke: a cross-sectional study in people with chronic stroke. *Arch Phys Med Rehabil* 2012; 93:1101-1107.
9. Powell LE, Myers AM. The Activities-specific Balance Confidence (ABC) scale. *J Gerontol A Biol Sci Med Sci* 1995; 50A:M28-34.
10. Tinetti ME, Richman D, Powell L. Falls efficacy as a measure of fear of falling. *J Gerontol* 1990; 45:P239-243.
11. Tinetti ME, Powell L. Fear of falling and low self-efficacy: a cause of dependence in elderly persons. *J Gerontol* 1993; 48 Spec No:35-38.
12. Yardley L, Beyer N, Hauer K, Kempen G, Piot-Ziegler C, Todd C. Development and initial validation of the Falls Efficacy Scale-International (FES-I). *Age Ageing* 2005; 34:614-619.

13. Hellström K, Lindmark B. Fear of falling in patients with stroke: a reliability study. *Clin Rehabil* 1999; 13:509-517.
14. Moore DS, Ellis R. Measurement of fall-related psychological constructs among independent-living older adults: a review of the research literature. *Aging Ment Health* 2008; 12:684-699.
15. World Health Organization. *International Classification of Functioning, Disability and Health: ICF*. Geneva: World Health Organization; 2001.
16. Cieza A, Brockow T, Ewert T, et al. Linking health-status measurements to the International Classification of Functioning, Disability and Health. *J Rehabil Med* 2002; 34:205-210.
17. Cieza A, Geyh S, Chatterji S, Kostanjsek N, Ustun B, Stucki G. ICF linking rules: an update based on lessons learned. *J Rehabil Med* 2005; 37:212-218.
18. Stucki G, Kostanjsek N, Ustun B, Cieza A. ICF-based classification and measurement of functioning. *Eur J Phys Rehabil Med* 2008; 44:315-328.
19. Geyh S, Cieza A, Kollerits B, Grimby G, Stucki G. Content comparison of health-related quality of life measures used in stroke based on the International Classification of Functioning, Disability and Health (ICF): a systematic review. *Qual Life Res* 2007; 16:833-851.
20. Fayed N, Cieza A, Bickenbach JE. Linking health and health-related information to the ICF: a systematic review of the literature from 2001 to 2008. *Disabil Rehabil* 2011; 33:1941-1951.
21. Lachman ME, Howland J, Tennstedt S, Jette A, Assmann S, Peterson EW. Fear of falling and activity restriction: the survey of activities and fear of falling in the elderly (SAFE). *J Gerontol B Psychol Sci Soc Sci* 1998; 53:P43-50.
22. Jorgensen MG, Laessoe U, Hendriksen C, Faurholt Nielsen OB, Aagaard P. Efficacy of Nintendo Wii training on mechanical leg muscle function and postural balance in community-dwelling older adults: a randomized controlled trial. *J Gerontol A Biol Sci Med Sci* 2012; Oct 31.
23. Moore DS, Ellis R, Kosma M, Fabre JM, McCarter KS, Wood RH. Comparison of the validity of four fall-related psychological measures in a community-based falls risk screening. *Res Q Exerc Sport* 2011; 82:545-554.

24. Blennerhassett JM, Dite W, Ramage ER, Richmond ME. Changes in balance and walking from stroke rehabilitation to the community: a follow-up observational study. *Arch Phys Med Rehabil* 2012; 93:1782-1787.
25. Jellesmark A, Herling SF, Egerod I, Beyer N. Fear of falling and changed functional ability following hip fracture among community-dwelling elderly people: an explanatory sequential mixed method study. *Disabil Rehabil* 2012; 34:2124-2131.
26. Nordell E, Andreasson M, Gall K, Thorngren K-G. Evaluating the Swedish version of the Falls Efficacy Scale-International (FES-I). *Advances in Physiotherapy* 2009; 11:81-87.
27. Nilsson MH, Hariz GM, Iwarsson S, Hagell P. Walking ability is a major contributor to fear of falling in people with Parkinson's disease: implications for rehabilitation. *Parkinsons Dis* 2012; 2012:713236.
28. Lehmann K, Sunnerhagen KS, Willén C. Postural control in persons with late effects of polio. *Acta Neurol Scand* 2006; 113:55-61.
29. Arnold CM, Faulkner RA, Gyurcsik NC. The Relationship between falls efficacy and improvement in fall risk factors following an exercise plus educational intervention for older adults with hip osteoarthritis. *Physiother Can* 2011; 63:410-420.
30. Plummer-D'Amato P, Cohen Z, Dae NA, Lawson SE, Lizotte MR, Padilla A. Effects of once weekly dual-task training in older adults: a pilot randomized controlled trial. *Geriatr Gerontol Int* 2012; 12:622-629.
31. Rahman S, Griffin HJ, Quinn NP, Jahanshahi M. On the nature of fear of falling in Parkinson's disease. *Behav Neurol* 2011; 24:219-228.
32. Nilsson MH, Westergren A, Carlsson G, Hagell P. Uncovering indicators of the International Classification of Functioning, Disability, and Health from the 39-item Parkinson's disease Questionnaire. *Parkinsons Dis* 2010; 2010:984673.
33. Lexell J, Malec JF, Jacobsson LJ. Mapping the Mayo-Portland Adaptability Inventory to the International Classification of Functioning, Disability and Health. *J Rehabil Med* 2011; 44:65-72.
34. Gradinger F, Glässel A, Bentley A, Stucki A. Content comparison of 115 health status measures in sleep medicine using the International Classification of Functioning, Disability and Health (ICF) as a reference. *Sleep Med Rev* 2011; 15:33-40.

35. Alghwiri AA, Marchetti GF, Whitney SL. Content comparison of self-report measures used in vestibular rehabilitation based on the International Classification of Functioning, Disability and Health. *Phys Ther* 2011; 91:346-357.
36. Bishop MD, Patterson TS, Romero S, Light KE. Improved fall-related efficacy in older adults related to changes in dynamic gait ability. *Phys Ther* 2010; 90:1598-1606.
37. Fletcher PC, Hirdes JP. Restriction in activity associated with fear of falling among community-based seniors using home care services. *Age Ageing* 2004; 33:273-279.
38. Kelsey JL, Procter-Gray E, Berry SD, et al. Reevaluating the implications of recurrent falls in older adults: location changes the inference. *J Am Geriatr Soc* 2012; 60:517-524.
39. Lehtola S, Koistinen P, Luukinen H. Falls and injurious falls late in home-dwelling life. *Arch Gerontol Geriatr* 2006; 42:217-224.
40. Talbot LA, Musiol RJ, Witham EK, Metter EJ. Falls in young, middle-aged and older community dwelling adults: perceived cause, environmental factors and injury. *BMC Public Health* 2005; 5:86.
41. Okuma Y, Yanagisawa N. The clinical spectrum of freezing of gait in Parkinson's disease. *Mov Disord* 2008; 23 Suppl 2:S426-430.
42. Hobart J, Cano S. Improving the evaluation of therapeutic interventions in multiple sclerosis: the role of new psychometric methods. *Health Technol Assess* 2009; 13:iii, ix-x, 1-177.
43. Nutt JG, Horak FB, Bloem BR. Milestones in gait, balance, and falling. *Mov Disord* 2011; 26:1166-1174.
44. Staniszewska S, Haywood KL, Brett J, Tutton L. Patient and public involvement in patient-reported outcome measures: evolution not revolution. *Patient* 2012; 5:79-87.
45. Faes MC, Reelick MF, Joosten-Weyn Banningh LW, Gier M, Esselink RA, Olde Rikkert MG. Qualitative study on the impact of falling in frail older persons and family caregivers: foundations for an intervention to prevent falls. *Aging Ment Health* 2010; 14:834-842.
46. Huang TT. Managing fear of falling: Taiwanese elders' perspective. *Int J Nurs Stud* 2005; 42:743-750.

Table 1. Detailed information of the linking of overall questions and response categories of 4 fear of falling rating scales to the International Classification of Functioning, Disability and Health

Scale	Overall Question and Response Categories	ICF Category	Additional Information
FES-I	Q: Now we would like to ask some questions about how concerned you are about the possibility of falling	b152 Emotional functions nd: not definable	Concerned Falling
	RC: Not at all/somewhat/fairly/very concerned	b152 Emotional functions	Not at all/somewhat/ fairly/very concerned
FES(S)	Q: How confident are you that you can ... without falling?	b1266 Confidence * nd: not definable	Falling
	RC: Not confident at all/fairly confident/completely confident	b1266 Confidence *	Not at all/fairly/ completely
ABC	Q: How confident are you that you will not lose your balance or become unsteady when you...?	b1266 Confidence *	
		b755 Involuntary movement reaction functions	Lose your balance
	b755 Involuntary movement reaction functions	Become unsteady	
RC: No confidence/completely confident	b1266 Confidence *	No/completely	
SAFFE	Q: Do you avoid doing certain things because of a risk of falling?	d Activities and participation nd: not definable	Avoid doing Falling
	RC: Would never/sometimes/always avoid	d Activities and participation	Never/sometimes/ always avoid

ICF = International Classification of Functioning, Disability and Health; FES-I = Falls Efficacy Scale-International; FES(S) = Swedish version of the Falls Efficacy Scale; ABC = Activities-specific Balance Confidence scale; SAFFE = modified Survey of Activities and Fear of Falling in the Elderly; Q = overall question; RC = response category; b = ICF component of body functions; d = ICF component of activities and participation.

The overall questions and the response categories refer to the items shown in Tables 4-7.

*The ICF category was decided in consensus after discussions between all 4 authors, as opposed to the other ICF categories, which were decided by the 3 linkers.

Table 2. Content comparison of the 62 items of 4fear of falling rating scales, using the International Classification of Functioning, Disability and Health as a reference

ICF Category	FES-I	FES(S)	ABC	SAFFE
b Body functions	–	–	–	–
s Body structures	–	–	–	–
d Activities and participation	–	–	–	–
d1 Learning and applying knowledge	–	–	–	–
d2 General tasks and demands	–	1	–	–
d3 Communication	1	1	–	–
d4 Mobility	15	9	21	11
d5 Self-care	4	6	–	4
d6 Domestic life	6	5	2	3
d7 Interpersonal interactions and relationships	–	–	–	–
d8 Major life areas	–	–	–	–
d9 Community, social and civic life	7	–	–	4
e Environmental factors	–	–	1	–

ICF = International Classification of Functioning, Disability and Health; FES-I = Falls Efficacy Scale-International; FES(S) = Swedish version of the Falls Efficacy Scale; ABC = Activities-specific Balance Confidence scale; SAFFE = modified Survey of Activities and Fear of Falling in the Elderly.

The values represent the number of linkages, presented on ICF component and chapter levels.

Please note: Data do not include linking of the overall questions and the response categories (see Table 1).

Table 3. Quantitative summary of the linking of the 62 items of 4 fear of falling rating scales to the International Classification of Functioning, Disability and Health

	FES-I	FES(S)	ABC	SAFFE
No. of items	16	13	16	17
No. of meaningful concepts				
Total	33	22	24	22
Per item (content density)	2.1	1.7	1.5	1.3
Unique ICF categories used for linkage				
Total, n	18	15	13	17
Per meaningful concept (content diversity)	0.5	0.7	0.5	0.8
Bandwidth of content coverage, %*	1.2	1.0	0.9	1.2

ICF = International Classification of Functioning, Disability and Health; FES-I = Falls Efficacy Scale-International; FES(S) = Swedish version of the Falls Efficacy Scale; ABC = Activities-specific Balance Confidence scale; SAFFE = modified Survey of Activities and Fear of Falling in the Elderly.

*% used ICF categories of the total number of ICF categories, ie, 1454.

Please note: High content density, content diversity and bandwidth of content coverage can be both positive and negative (see discussion "Interpretation of Quantitative Measures of the Linking Process"). Data do not include linking of the overall questions and the response categories (see Table 1).

Table 4. Detailed information of the linking of the Falls Efficacy Scale-International (FES-I) items to the International Classification of Functioning, Disability and Health

Item	ICF Category	Additional Information
1. Cleaning the house (eg, sweep the floor, vacuum or dust)	d6402 Cleaning living area (d6402) Cleaning living area (d6403) Using household appliances (d6402) Cleaning living area	
2. Getting dressed or undressed	d540 Dressing d540 Dressing	
3. Preparing simple meals	d6300 Preparing simple meals	
4. Taking a bath or shower	d5101 Washing whole body d5101 Washing whole body	
5. Buying some groceries	d6200 Shopping	Some groceries
6. Getting in or out of a chair	d4103 Sitting d4103 Sitting	In a chair Out of a chair
7. Climbing stairs	d4551 Climbing	
8. Walking around in the neighbourhood	d4602 Moving around outside the home and other buildings *	
9. Reaching for something above your head or on the ground	d4452 Reaching d4105 Bending	Above your head On the ground
10. Answering the telephone before it stops ringing	d3600 Using telecommunication devices	Answering the telephone
11. Walking on a slippery surface (eg, wet or icy)	d4502 Walking on different surfaces (d4502) Walking on different surfaces (d4502) Walking on different surfaces	Slippery Wet
12. Visiting acquaintances, friends or relatives	d9205 Socializing d9205 Socializing d9205 Socializing	Acquaintances
13. Walking in crowds	d4503 Walking around obstacles	
14. Walking on an uneven surface (eg, rocky ground, poorly maintained pavement)	d4502 Walking on different surfaces (d4502) Walking on different surfaces (d4502) Walking on different surfaces	Rocky ground Poorly maintained pavement
15. Walking up or down a slope	d4502 Walking on different surfaces d4502 Walking on different surfaces	
16. Participating in a social event (eg, family gathering, club meeting or religious service)	d9 Community, social and civic life (d9205) Socializing (d910) Community life (d9300) Organized religion	Participating in a social event Club meeting Religious service

ICF = International Classification of Functioning, Disability and Health.

*The ICF category was decided in consensus after discussions between all 4 authors, as opposed to the other ICF categories, which were decided by the 3 linkers.

Table 5. Detailed information of the linking of the Swedish version of the Falls Efficacy Scale (FES[S]) items to the International Classification of Functioning, Disability and Health

Item	ICF Category	Additional Information
1. Get in and out of bed	d4100 Lying down	In bed
	d4100 Lying down	Out of bed
2. Go to the toilet	d530 Toileting	
3. Wash yourself	d510 Washing oneself	
4. Get in and out of a chair	d4103 Sitting	In a chair
	d4103 Sitting	Out of a chair
5. Get dressed and undressed	d540 Dressing	
	d540 Dressing	
6. Take a bath or a shower	d5101 Washing whole body	
	d5101 Washing whole body	
7. Go up and down stairs	d4551 Climbing	
	d4551 Climbing	
8. Walk around the neighbourhood	d4602 Moving around outside the home and other buildings *	
9. Reach into cupboards/closets	d4452 Reaching	Into cupboards/closets
10. Clean the apartment (ie, sweep or dust)	d6402 Cleaning living area	
	(d6402) Cleaning living area	
	(d6402) Cleaning living area	
11. Prepare a meal that does not require carrying hot or heavy objects	d630 Preparing meals	
	d4301 Carrying in the hands	Hot or heavy objects
12. Hurrying up to answer the telephone	d2401 Handling stress	Hurrying up
	d3600 Using telecommunication devices	Answer the telephone
13. Simple shopping	d6200 Shopping	Simple shopping

ICF = International Classification of Functioning, Disability and Health.

*The ICF category was decided in consensus after discussions between all 4 authors, as opposed to the other ICF categories, which were decided by the 3 linkers.

Table 6. Detailed information of the linking of the Activities-specific Balance Confidence Scale (ABC) items to the International Classification of Functioning, Disability and Health

Item	ICF Category	Additional Information
1. Walk around the house	d4600 Moving around within the home	
2. Walk up or down stairs	d4551 Climbing d4551 Climbing	
3. Bend over and pick up a shoe from the floor	d4105 Bending d4452 Reaching	Shoe from the floor
4. Reach for a small can off a shelf at eye level	d4452 Reaching	Small can off a shelf at eye level
5. Stand on your tiptoes and reach for something above your head	d4154 Maintaining a standing position d4452 Reaching	On your tiptoes Above your head
6. Stand on a chair and reach for something	d4154 Maintaining a standing position d4452 Reaching	On a chair
7. Sweep or vacuum the floor	d6402 Cleaning living area d6403 Using household appliances	The floor
8. Walk to a taxi that is waiting by the sidewalk	d4500 Walking short distances	To a taxi
9. Get into or out of a car	d410 Changing basic body position d410 Changing basic body position	Get into a car Get out of a car
10. Cross a street	d4503 Walking around obstacles *	Cross a street
11. Step onto or off a curb	d4551 Climbing * d4551 Climbing *	Step onto a curb Step off a curb
12. Walk on a street where people are rapidly passing	d4503 Walking around obstacles	
13. Others bump into you as you walk on the street	e Environmental factors d4503 Walking around obstacles	Others bump into you
14. Travel by bus <i>without</i> a bag of groceries	d4702 Using public motorized transportation	Without a bag of groceries
15. Travel by bus <i>with</i> a bag of groceries	d4702 Using public motorized transportation	With a bag of groceries
16. Walk on icy sidewalks	d4502 Walking on different surfaces	Icy sidewalks

ICF = International Classification of Functioning, Disability and Health.

*The ICF category was decided in consensus after discussions between all 4 authors, as opposed to the other ICF categories, which were decided by the 3 linkers.

Table 7. Detailed information of the linking of the modified Survey of Activities and Fear of Falling in the Elderly (SAFFE) items to the International Classification of Functioning, Disability and Health

Item	ICF Category	Additional Information
1. Walk to the store and shop	d460 Moving around in different locations d6200 Shopping	
2. Clean your house	d6402 Cleaning living area	
3. Prepare simple meals	d6300 Preparing simple meals	
4. Go to the doctor or dentist	d5702 Maintaining one's health d5702 Maintaining one's health	Go to the doctor Go to the dentist
5. Take a bath	d5101 Washing whole body	
6. Take a shower	d5101 Washing whole body	
7. Go for a walk	d450 Walking	
8. Go out when it is slippery	d4502 Walking on different surfaces	Slippery
9. Visit a friend or relative	d9205 Socializing d9205 Socializing	
10. Walk to a place with crowds	d4503 Walking around obstacles	
11. Climb stairs	d4551 Climbing	
12. Walk around indoors	d460 Moving around in different locations	
13. Walk a kilometer	d4500 Walking short distances	A kilometer
14. Bend down to pick up something	d4105 Bending d4400 Picking up	
15. Travel by public transport	d4702 Using public motorized transportation	
16. Attend a social event or party	d9 Community, social and civic life d9 Community, social and civic life	Attend a social event Attend a party
17. Reach for something above your head	d4452 Reaching	Above your head

ICF = International Classification of Functioning, Disability and Health.

Supplementary Table 1. Detailed content comparison of items of four fear of falling rating scales, using the International Classification of Functioning, Disability and Health as a reference

ICF Category	FES-I	FES(S)	ABC	SAFFE
d Activities and participation	–	–	–	–
d2 General tasks and demands	–	–	–	–
d2401 Handling stress	–	1	–	–
d3 Communication	–	–	–	–
d3600 Using telecommunication devices	1	1	–	–
d4 Mobility	–	–	–	–
d410 Changing basic body position	–	–	2	–
d4100 Lying down	–	2	–	–
d4103 Sitting	2	2	–	–
d4105 Bending	1	–	1	1
d4154 Maintaining a standing position	–	–	2	–
d4301 Carrying in the hands	–	1	–	–
d4400 Picking up	–	–	–	1
d4452 Reaching	1	1	4	1
d450 Walking	–	–	–	1
d4500 Walking short distances	–	–	1	1
d4502 Walking on different surfaces	8	–	1	1
d4503 Walking around obstacles	1	–	3	1
d4551 Climbing	1	2	4	1
d460 Moving around in different locations	–	–	–	2
d4600 Moving around within the home	–	–	1	–
d4602 Moving around outside the home and other buildings	1	1	–	–
d4702 Using public motorized transportation	–	–	2	1
d5 Self-care	–	–	–	–
d510 Washing oneself	–	1	–	–
d5101 Washing whole body	2	2	–	2
d530 Toileting	–	1	–	–
d540 Dressing	2	2	–	–
d5702 Maintaining one's health	–	–	–	2
d6 Domestic life	–	–	–	–
d6200 Shopping	1	1	–	1
d630 Preparing meals	–	1	–	–
d6300 Preparing simple meals	1	–	–	1
d6402 Cleaning living area	3	3	1	1
d6403 Using household appliances	1	–	1	–
d9 Community, social and civic life	1	–	–	2
d910 Community life	1	–	–	–
d9205 Socializing	4	–	–	2
d9300 Organized religion	1	–	–	–

e Environmental factors

- - 1 -

ICF = International Classification of Functioning, Disability and Health; FES-I = Falls Efficacy Scale-International; FES(S) = Swedish version of the Falls Efficacy Scale; ABC = Activities-specific Balance Confidence scale; SAFFE = modified Survey of Activities and Fear of Falling in the Elderly.

The values represent the number of linkages, presented on the most precise ICF levels.

Please note: Data do not include linking of the overall questions and the response categories (see Table 1).