

SYSTEMATIC REVIEW

Fear of falling: measurement strategy, prevalence, risk factors and consequences among older persons

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Abstract

Background fear of falling (FOF) is a major health problem among the elderly living in communities, present in older people who have fallen but also in older people who have never experienced a fall. The aims of this study were 4-fold: first, to study methods to measure FOF; second, to study the prevalence of FOF among fallers and non-fallers; third, to identify factors related to FOF; and last, to investigate the relationship between FOF and possible consequences among community-dwelling older persons.

Methods several databases were systematically searched, and selected articles were cross-checked for other relevant publications.

Results a systematic review identified 28 relevant studies among the community-dwelling elderly. Due to the many different kinds of measurements used, the reported prevalence of FOF varied between 3 and 85%. The main risk factors for developing FOF are at least one fall, being female and being older. The main consequences were identified as a decline in physical and mental performance, an increased risk of falling and progressive loss of health-related quality of life.

Conclusion this review shows that there is great variation in the reported prevalence of FOF in older people and that there are multiple associated factors. Knowledge of risk factors of FOF may be useful in developing multidimensional strategies to decrease FOF and improve quality of life. However, the only identified modifiable risk factor of FOF is a previous fall. In order to measure the impact of interventions, a uniform measurement strategy for FOF should be adopted, and follow-up studies should be conducted.

Keywords: *fear of falling, prevalence, risk factors, measurement, older persons, elderly, systematic review*

Introduction

Falls are the leading cause of injury-related death, and the third leading cause of poor health among persons aged 65 years and older [1, 2]. Each year in the Netherlands, 89,000 older persons visit the emergency department because of a fall-related injury, and one-third of this group is admitted in hospital [2]. Over 30% of community-dwelling

older persons fall each year, and 15% fall more than once. Almost 33% of the older population experiences functional decline after a fall [2]. Many older persons experience psychological difficulties directly related to the fall [3]. Among these psychological consequences are fear of falling (FOF), loss of self-efficacy, activity avoidance and loss of self-confidence [3]. Self-efficacy, introduced in 1978 by

Bandura, refers to ‘an individual’s perception of capabilities within a particular domain of activities’.

For a long time, FOF was merely believed to be a result of the psychological trauma of a fall, also called ‘post-fall syndrome’ [3]. This syndrome was first mentioned in 1982 by Murphy and Isaacs, who noticed that after a fall, ambulatory persons developed intense fear and walking disorders. FOF has been identified as one of the key symptoms of this syndrome. Since that time, FOF has gained recognition as a specific health problem among older adults. However, FOF was also commonly found among elderly persons who had not yet experienced a fall [4, 5].

Diagnosing FOF has been the subject of many studies using different measurement techniques. A systematic investigation of these instruments was undertaken to answer the following research questions: (i) which instruments for measuring FOF can be found in the literature, (ii) what is the prevalence of FOF, (iii) what are the risk factors of (developing) FOF, (iv) what are the consequences of FOF?

Therefore, this study consists of a systematic review concerning measurement instruments, prevalence, risk factors and consequences of FOF in community-dwelling older persons.

Methods

Database sources

Three search strategies were used to retrieve relevant articles for this review. English and Dutch language literature was systematically searched from 1990 to December 2006 using Pubmed. Next, searches of PsychINFO, CINAHL and the Cochrane Database of Systematic Reviews (CSDR) were undertaken using the same search strategy, and no new articles were found. Finally, reference lists of all selected articles were reviewed to identify other relevant papers.

Search terms

The Medline database was used to search for Medical Subject Headings (MeSH) to select search terms, which were not limited by study design. The methodological filters used were age more than 65 years old, English language and humans. The key terms of this search were: elderly frail OR aged OR older persons falling OR, accidental falling; and FOF. The search strategies were customised to each database. In this systematic review, community-living older persons are defined as seniors over 65 years of age, living either independently or with home care services in a community. A fall is defined as an unintentional change in body position resulting in contact with the ground or another lower level [2].

Overview of MeSH terms and words used to search the electronic databases

- (1) Population: ‘elderly’, ‘frail’, ‘aged’ or ‘older persons’; 896,881 hits.
- (2) Condition: ‘FOF’; 173 hits.
- (3) Outcome: ‘fall’ or ‘accidental falling’; 6,530 hits.
- (4) Combination of (1) and (2) and (3); 147 hits.

Selection criteria

In total, 147 studies were eligible. Based on titles, studies in languages other than Dutch or English were excluded along with case reports ($n = 12$). Studies solely concerning the elderly with specific conditions were also excluded ($n = 24$). The abstracts of the remaining 111 articles were read independently by two investigators (AC and SR). Studies with a majority of participants younger than 65 years were excluded ($n = 3$). Studies on older persons living in nursing homes or during a hospital stay were also excluded ($n = 9$). Some studies were related to falling or gait and balance problems solely, and were not directly correlated with FOF. These studies were therefore not included ($n = 42$). On the basis of the above-mentioned criteria, a total of 57 abstracts met all inclusion criteria and remained as potential material for this review. These original papers were retrieved and considered for their ability to answer one or more of the research questions. After review, 24 articles did not fully apply to any of our research (sub) questions and were therefore excluded.

Search results

The systematic search resulted in 33 articles; three systematic reviews and 30 studies on aspects of FOF. These 33 studies were assessed for methodological quality by using the Centre for Evidence-Based Medicine (EBM), Critical Appraisal Tools, for reviewing diagnostic studies, studies on prognosis (risk factors and consequences) and systematic reviews [6]. From 30 studies on aspects of FOF, eight studies described the development of an instrument to measure FOF [7–14]. These studies were reviewed using the Critical Appraisal Tool for diagnostic studies (Appendix I, available online at <http://ageing.oxfordjournals.org>). One of these studies was excluded due to weak methodological quality. The other 22 articles on aspects of FOF were assessed for methodological quality using the Critical Appraisal Form on prognosis (Appendix II, available online at <http://ageing.oxfordjournals.org>). On the basis of this assessment, another two articles were excluded. Two out of the three identified reviews were narrative reviews (Appendix III, available online at <http://ageing.oxfordjournals.org>) and were therefore excluded. This left a remainder of 28 studies which met inclusion criteria and had adequate to good methodological quality. Nineteen studies were cross-sectional, and nine were prospective. Sample sizes varied from 18 to 2,497 subjects. The eight prospective studies showed a percentage follow-up between 21 and 98% [11, 15–22]. Eight out of 28 studies also included persons who had not experienced a fall [15, 16, 19, 20, 23–26].

Results

Measurement instruments

Ten instruments were retrieved for measuring FOF (Table 1, available online at <http://ageing.oxfordjournals.org>). Different constructs have been used to measure FOF: self-efficacy

measures (i.e. measurements testing the ability to produce an intended result by oneself in relation to FOF), FOF measures and activity-related measures.

Two instruments were found to measure fall-related efficacy: the Fall Efficacy Scale (FES) and the Activities-specific Balance and Confidence Scale (ABC) [10, 11]. The FES assesses the degree of perceived self-efficacy at avoiding a fall during basic activities of daily living (ADL) [11]. Different versions of this instrument have evolved [7, 8, 12, 14, 26]. A reversed response format is used in the revised FES (rFES), with a low score corresponding to low rather than high confidence [26]. The modified FES (mFES) includes four additional questions about outdoor activities [8]. The Falls Efficacy Scale–International (FES-I) assesses both easy and difficult physical activities and social activities, and it has been translated and validated in different languages [14]. The FES-NL is an unmodified Dutch version of the FES [7].

The ABC is a measure of balance confidence [10]. The ABC items include a wider continuum of activity difficulty than the FES. This instrument focuses on whether people believe they are able to perform ADLs without losing balance or becoming unsteady. The Dutch translation, the ABC-NL, includes seven additional items about complex/dual tasks [12].

The other eight instruments measured FOF and include besides the amended Falls Efficacy Scale (amFES) and the Survey of Activities and FOF in the Elderly (SAFFE), six single-item questions used in 12 studies [9, 15, 16, 18–20, 25–27, 30, 31, 33]. Whereas the amended FES (amFES) [27] measures self-efficacy, the items of the scale relate to FOF. The SAFFE assesses FOF and activity restriction [9]. The SAFFE-NL is a Dutch version of the SAFFE [17].

Twenty-two studies addressed the psychometric qualities of the instruments (Table 1, available online at <http://ageing.oxfordjournals.org>). Internal consistency was examined in two self-efficacy measures and in only one FOF measure. The FES, rFES, modified Falls Efficacy Scale (moFES), FES-I, ABC, ABC-NL and SAFFE have excellent internal consistency with a Cronbach's alpha ($Cr.\alpha$) ≥ 0.90 , and the FES-NL has good internal consistency ($Cr.\alpha > 0.80$). Test–retest was tested in six instruments and measured as a reliability coefficient (Cohen's Kappa, Intra-Class Correlation Coefficient (ICC) or correlation coefficient). In three studies, the test and retest were administered by the same person, and in the other studies this was not mentioned. Inter-rater reliability was excellent for rFES, moFES, FES-I, ABC and instrument 1 ($\kappa \geq 0.4$, $r \geq 0.9$, $ICC \geq 0.7$) and poor for FES and instrument 2 ($\kappa < 0.4$, $ICC < 0.7$). The inter-item variability was tested in three studies: the FES-I, the FES-NL and the ABC-NL are homogenous scales with average inter-item correlations > 0.4 .

The content validity of the measures was established using expert panels (FES, FES-I, ABC, SAFFE), and one also involved older people in the development (ABC).

Convergent validity was tested in five self-efficacy measures, in two FOF measures and in one activity-related measure. As related criteria, measures of physical, psychological and social functioning were used. Six out of eight instruments that were tested for convergent validity were tested by at least two criteria, and overall, the correlations found were weak to adequate.

Construct validity was tested in three versions of the FES, in both versions of the ABC and in three FOF measures. In the development of FES, FES-NL, ABC and ABC-NL, construct validity was studied in extreme groups using the Student's *t*-test (*t*). Both FES and ABC scores were significantly different for high and low mobility groups (Student's *t* = 5.7 for FES, *t* = 9.34 for ABC). FES-NL scores were significantly higher for fallers (5.71) and for older persons with dizziness (8.31). Fallers and older persons avoiding activity had significantly higher ABC-NL scores (range score 3.63–3.90, resp. 6.09–6.82). In two instruments (moFES, FES-I), construct validity was confirmed with factor analysis. Testing for concurrent validity was performed in FES, ABC, instrument 2 and amFES.

Of the nine instruments reviewed, the moFES, FES-I, FES-NL, ABC-NL, instrument 5, instrument 6, amFES and SAFFE-NL methods were only tested in a single study. However, FES-I, FES-NL, ABC-NL and SAFFE-NL were only developed recently (2004–2005). The reliability and validity of single-item measures were limited. For all single-item measures except one, no aspects of reliability or validity were tested.

Prevalence of fear of falling

Twenty-one studies were found which address the prevalence of FOF (Table 2, available online at <http://ageing.oxfordjournals.org>). One study reported a prevalence of 3% among non-dizzy community-dwelling elderly persons, while all other studies reported prevalences between 20.8 and 85%. Studies included between 18 and 2,497 persons, and 13 studies had a sample size of less than 500 persons.

Most studies had a cross-sectional design, while eight studies were prospective [11, 15, 16, 18–22]. Fourteen studies described FOF as activity-related FOF [9, 10, 12, 17, 21–25, 27, 28, 30, 32, 33].

For this review, eight relevant studies were found that were reporting on FOF, including subjects who had not experienced a fall event [15, 16, 19, 20, 23–26]. These studies show that over 50% of persons with FOF did not experience a fall. In studies where FOF was related to an activity such as 'reaching for something over your head,' the highest prevalence noted was, 85% [5].

Only two of them, namely Friedman *et al.* (2002) [18] and Murphy *et al.* (2003) [20] were able to provide an incidence, as these studies were in patients who experienced a fall for the first time during follow-up and developed FOF. The incidence of FOF varied in these studies between 11.6 and 23.3% in patients without a fall during follow-up, and 20.6–39% in patients without FOF at baseline developing FOF after a fall during follow-up.

Risk factors of (developing) fear of falling

Seventeen studies reported on risk factors associated with FOF (Table 3, available online at <http://ageing.oxfordjournals.org>). Only one study included fallers alone; all other studies included both fallers and non-fallers [21]. All studies were designed as case-control studies using FOF as an outcome measure. Due to different constructs used to measure FOF (self-efficacy, FOF and activity-related measures), it was difficult to compare the different studies. Despite this fact, having had at least one fall is reported in most studies as an independent risk factor for developing FOF [7–9, 18, 20, 24, 25, 27, 34]. Two studies showed the development of FOF as an immediate consequence of falling [18, 20], others found that subsequent falls significantly increased the risk of FOF. Some authors studied an earlier fall as a risk factor retrospectively [7–9, 24, 25, 27, 34], and the odds ratio (OR) for this risk factor varied between 1.58 and 3.90.

Prevalence of FOF appeared to increase with age and to be higher in women. In six studies, age remained significant in multiple logistic regression analyses [7–9, 18, 20, 34]. Gender was reported as a risk factor in nine studies, and gender was found to be a non-significant risk factor for FOF in three studies [9, 25, 34].

Other risk factors for FOF have been studied, but less frequently. Dizziness was mentioned as a factor in five studies [7, 20, 24, 31, 34]. Self-rated health status was identified as a risk factor of FOF in four studies [15, 19, 33, 34]. Depression also appeared to be a risk factor in four studies [11, 25, 27, 31]. In these studies however, two different instruments were used to measure depression (Center for Epidemiologic Study–Depression Scale [11, 30, 34], and the SCL-90-R sub-scale depression [27]). Various authors studied problems with gait and balance as a risk factor for developing FOF [11, 15, 19, 21, 27]. One study including only persons who experienced a fall showed a relationship between gait abnormalities and FOF (OR 4.48, 95% CI 1.70–11.83) [21]. This study also showed cognitive complaints (OR 2.26, 95% CI 1.15–4.44) and low economic resources (OR 2.36, 95% CI 1.19–4.70) to be risk factors. Functional dependence in ADL as a risk factor for FOF was investigated in two studies [5, 25].

Consequences of fear of falling

Fourteen studies addressed the question of the consequences of a fall (Table 4, available online at <http://ageing.oxfordjournals.org>). Only five studies were prospective with a follow-up period of at least 1 year, and follow-up varied between 32 and 98%. All studies compared patients with and without FOF, and showed FOF leading to physical, functional, psychological and social changes in older adults.

With regard to physical consequences, falling was reported in four studies as a consequence of FOF [16–18, 32]. In a prospective study, falling was a consequence during

12 months of follow-up when FOF was measured by FES (OR 2.09, 95% CI 1.31–3.33). When FOF was assessed by a single-item measurement, falling was not a risk factor. FOF was associated with a decrease in physical activity or physical health [5, 16, 21, 26, 32]. Two studies used the Short Form 36 (SF-36) Health Survey to measure physical activity [5, 16]; Tinetti *et al.* [26] assessed physical activity using the Yale Physical Activity Survey, and Li *et al.* [32] computed the activity level by counting the number of achieved activities included in the SAFFE. Also, balance and gait problems appeared to be strongly associated with FOF in several studies, although they were measured using different tests and scales [21, 23, 32].

Nine studies reported on one or more functional consequences of FOF using different measurement instruments [9, 16, 22–24, 26, 30, 28, 32]. Five studies reported on cutting down on activities or avoidance of activities [9, 22–24, 26]. Lachman *et al.* [9] found that high FOF scores as assessed by the SAFFE result in not being engaged in a given activity. The Consequences of Falling (COF) Scale was developed by Yardley *et al.* [22] This instrument showed that the most common beliefs concerning the negative consequences of falling, namely, loss of functional independence and the social consequence of damage to identity, were independently associated with FOF.

A reduction in social activity is another social consequence of FOF, and was studied in three studies [5, 9, 26]. Two studies [5, 9] used the SF-36, and Tinetti *et al.* [26] assessed social activity participation with adaptations from the Established Populations Study of the Elderly interview.

Psychological factors have also been studied. Two studies [15, 31] found depression to be a consequence; one [15] used the Geriatric Depression Scale (GDS) to assess depression, while the other [31] used a sub-scale of the SCL-90. Mental health was also measured by a sub-scale of the SF-36 in two studies [5, 9] and by the Study Short Form (SF-12), a shorter version of the SF-36 [29]. Five studies showed decreased quality of life to be a consequence of FOF [5, 9, 15, 16, 23].

Discussion

This systematic review studied all available studies concerning measurement instruments, prevalence, risk factors and consequences of FOF in persons aged 65 years or older, living either independently or with home care services in the community. Various definitions of FOF have been derived from different investigations, resulting in many different measurement instruments for measuring FOF. Most studies on psychometrics were conducted using multi-item instruments measuring the construct of self-efficacy such as the FES and the ABC. Reliability of self-efficacy measures showed good to excellent results, and weak to adequate validity. Less evidence was available about psychometric qualities of single-item instruments measuring FOF.

Prevalences found ranged from 3% in one study to 21–85% in other studies, also among 50% of the older adults who had no experience of a fall. These large differences in prevalence raise the question of the validity and reliability of these studies. The main risk factor for FOF found was having had at least one fall. This finding is remarkable, since high prevalences are also found in non-fallers. Additionally, the prevalence of FOF was found to be higher in women than in men and appeared to increase with age. The main consequences of FOF described were physical, functional, psychological and social changes. Studies have shown FOF to be associated with negative consequences such as falling, less physical activity, restriction or avoidance of activities, depression, decreased social contact and lower quality of life. Since many of the studies describing risk factors and associated consequences used a cross-sectional design, no thorough conclusions can be made on causality.

The studies described in this review show different results, partly due to methodological differences (i.e. composition of measurement instruments, sample size of studied population) and possibly due to the lack of a standard classification for FOF and its consequences. Because of the many differently measured risk factors that contribute to FOF and the consequences of FOF, it may be difficult to develop an instrument that fully reflects a broad view of FOF [3].

Furthermore, the prospective studies reported on had a substantial loss to follow-up; subjects who did not complete the follow-up tended to be older, had more ADL deficiencies, more cognitive problems or lower quality of life [11, 17, 18, 20–24]. This could have created bias in the studied results.

Another possible bias was that the majority of the studies were cross-sectional, leaving conclusions subject to alternative interpretations of causal order.

A limitation to this systematic research is therefore the lack of large, prospective follow-up studies on FOF. The literature does not give clear insight into the incidence and natural course of FOF.

This information, however, is urgently needed since FOF is one of the potential modifiable risk factors where interventions could be effective in the prevention of falls.

In conclusion, FOF is a major health problem among community-living older people. There is great variation in the reported prevalence of FOF in older people, and there are multiple associated factors. Knowledge of risk factors of FOF may be useful in developing multidimensional strategies to decrease FOF and improve quality of life, however, the only identified modifiable risk factor of FOF is a previous fall. The findings of this systematic review also suggest that before more nationwide—or even internationally oriented prospective—longitudinal follow-up studies are conducted, a uniform measurement instrument for FOF is needed to make comparisons and outcome measurement of intervention studies possible. A better understanding of FOF can contribute to the early identification of FOF and

to more efficient interventions for primary (and secondary) prevention of falls in order to reduce some of the serious adverse health consequences of FOF.

Key points

- This review shows that FOF is highly prevalent among older persons.
 - Measurement of FOF lack uniformity of the instruments used.
 - Associated features with FOF are multi-factorial.
 - More prospective studies with adequacy of follow-up time are necessary to study the natural course of FOF and the efficacy of intervention such as fall prevention clinics.
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Conflict of interest

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Not required

Supplementary data

Supplementary data for this article are available online at <http://ageing.oxfordjournals.org>.

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