Fear of falling in older patients

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CHAPTER 3

PSYCHOMETRIC PROPERTIES OF THE VAS-FOF, A VISUAL ANALOGUE SCALE FOR FEAR OF FALLING IN OLDER PERSONS

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ABSTRACT

Background  Fear of falling (FOF) is a prominent symptom experienced by many older persons. FOF may even exist without earlier falls and may lead to physical, functional, psychological and social decline of functioning. The Visual Analogue Scale for Fear of Falling (VAS-FOF) is used by 23 fall clinics in the Netherlands to measure FOF in older persons who have experienced a fall.

Aim  To investigate the psychometric aspects of the VAS-FOF in older persons who have experienced a fall.

Patients: This study included 440 consecutive patients presenting to the Accident & Emergency Unit of a university teaching hospital after a non-accidental fall.

Method  Test-retest reliability was examined at a one-week interval. Construct validity was tested by determining the relationship between fear of falling and health related QoL. Concurrent validity was examined by using the Dutch version of the Falls Self Efficacy Scale (FES-NL) and the Dutch version of the Survey of Activities and Fear of Falling in the Elderly (SAFFE-NL).

Results  Test-retest reliability of VAS-FOF was fair (r_s=.56, p=0.01). The correlation between VAS for fear of falling and EQ-5D was -.37 (p=0.01). Concurrent validity measured by the correlation between VAS-FOF and FES-NL (r_s=.44, p=0.01) and SAFFE-NL (r_s=.48, p=0.01) was supported. Fear of falling was significantly associated with higher age, female gender and having a history of more than one fall.

Conclusions  There is support for the use of the VAS-FOF as an instrument to measure FOF, although probably another concept is measured with FES-NL and SAFFE-NL.
INTRODUCTION

Fear of falling (FOF) is a potentially serious problem in older adults living in the community.\textsuperscript{1-5} Estimates of the prevalence of FOF in community samples of older people range from 21% to 85\%,\textsuperscript{6} tending to be greater in women and increasing with age.\textsuperscript{1,7-9} This variability in prevalence of FOF is likely due to the various definitions and instruments used to measure FOF.\textsuperscript{6}

The main risk factor for developing FOF is experiencing at least one fall\textsuperscript{6}. Studies have shown FOF to be associated with negative behavioural consequences, including recurrent falling\textsuperscript{3,10-12}, reduced physical activity\textsuperscript{3,5,8,12}, restriction of activities\textsuperscript{2,3,8,13,14}, depression\textsuperscript{1,15}, decreased social contact\textsuperscript{5,8,13}, and overall lower quality of life (QoL).\textsuperscript{1,2,13} Older adults with FOF tend to have less confidence in performing activities of daily living without falling and therefore tend to restrict or avoid these activities.\textsuperscript{2,8,13,14,16}

Different definitions for FOF have resulted in the development of many different instruments to measure FOF. Numerous constructs to measure FOF are described, including self-efficacy measures, FOF specific measures (i.e. single-item instruments) and activity-related (multi-item) measures.\textsuperscript{6}

A method to measure FOF, that has not been investigated yet, is a Visual Analogue Scale (VAS).\textsuperscript{17} A VAS consists of a line, where the ends of the line represent the extreme limits of subjective phenomena.\textsuperscript{18} The VAS is useful for measuring a variety of subjective phenomena and provides a convenient, easy, and rapidly administered measurement strategy.\textsuperscript{19,20}

The present VAS for Fear of Falling (VAS-FOF) was developed as part of a self-assessment questionnaire, the Carefall Triage Instrument (CTI)\textsuperscript{20} and asks the patient to indicate perceived intensity of FOF (Box 1). The VAS-FOF is currently used by 23 fall prevention clinics in the Netherlands.\textsuperscript{20} Reliability and validity of this instrument have not been properly investigated yet. Therefore, this study aims to establish the psychometric properties of the VAS-FOF as method of assessing FOF in older persons living at home who have experienced a fall.
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METHODS

PATIENT POPULATION
Between May 2007 and July 2008, all patients aged 65 years and older, who presented to the Accident & Emergency (A&E) Department of the Academic Medical Centre, Amsterdam, the Netherlands, after a fall were eligible to participate. Exclusion criteria for the study included cognitive impairment, admittance to ICU or department of Neurology, language problems, death within 24 hours after the fall or living in a nursing home. This study was part of a larger, ongoing study, and was approved by the hospital’s Medical Ethics Committee.

PROCEDURE
As part of a standard procedure at the AMC, a research nurse reviews the A&E charts of all patients of 65 years and older daily. In order to measure modifiable risk factors for recurrent falling, patients with an accidental fall from standing position were sent the CTI. The CTI was used to collect socio-demographic data. Along with the fall-questionnaire patients received the VAS-FOF, the Dutch version of the Falls Efficacy Scale (FES-NL), the Dutch version of the Survey of Activities and Fear of Falling in the Elderly (SAFFE-NL) and the Visual Analogue Scale QoL (VAS-QoL), to study the different aspects of validity. Two weeks after the questionnaires were sent, non-respondents were reminded by telephone.

One week after the date questionnaires were filled in by the patient, a research nurse contacted the patient by phone to readminister the VAS-FOF. This second administration was done by phone, to shorten the elapsed time between the two measurements and to reduce the number of non-responders.

MEASURES

VISUAL ANALOGUE SCALE FOR FEAR OF FALLING (VAS-FOF)
The VAS-FOF uses a numeric scale (1-10) to measure the perceived FOF after a fall (Box 1). The participants were instructed to select the number that best reflects the
intensity of FOF experienced, with 1 representing no FOF and with 10 representing an extreme FOF.

**THE CAREFALL TRIAGE INSTRUMENT (CTI)**
The CTI allows a reliable and valid assessment of (modifiable) risk factors associated with recurrent falls in elderly patients.20

**FALLS EFFICACY SCALE (FES-NL)**
The Falls Efficacy Scale (FES) assesses the degree of perceived self-efficacy at avoiding a fall during basic activities of daily living (ADL).20 The FES-NL is an unmodified Dutch version of the FES. On a scale from 0 (not at all) to 3 (very), subjects are asked how concerned they are about the possibility of falling while performing ten different activities. If respondents indicated that they did not perform or were unable to perform the activity, a score of 0 was noted. The FES has good internal consistency ($\alpha=.91$)23, test-retest reliability ($r=0.71$)22, and construct validity3.

**DUTCH VERSION OF THE SURVEY OF ACTIVITIES AND FEAR OF FALLING IN THE ELDERLY (SAFFE-NL)**
Fear-related avoidance of activities was measured using a Dutch version of the modified SAFFE scale14, the self-administered version of the SAFE-scale developed by Lachman et al.13 This survey contains 17 items: all respondents used a three-point scale, ranging from never (1) to always (3), to indicate whether they would avoid certain activities in daily living because of FOF. The SAFE has excellent internal consistency ($\alpha=.92$) and good test-retest reliability ($r=0.75$).14 For the SAFFE-NL, aspects of reliability have not yet been established yet, but fear-related avoidance of activities is associated with previous falls and ‘general physical frailty’.10
**Visual Analogue Scale QoL (VAS-QoL)**

The VAS-QoL, part of the EQ-5D, generates a self-rating of health-related QoL on a vertical graduated VAS. The end points are labelled best imaginable health state at the top and worst imaginable health state at the bottom, having numerical values of 100 and 0 respectively (http://www.euroqol.org). Reliability and validity of the VAS-QoL has been established in various studies.\(^{17,24,25}\)

**Statistical Analysis**

SPSS, version 16.0 (SPSS inc. Chicago, Illinois), was used for statistical analyses. Socio-demographic data were expressed as percentages for categorical data, mean and standard deviation (SD) for normal distributed numerical data and as median and interquartile ranges (IQR) for non-normally distributed numerical data. Floor and ceiling effects of the distribution of the VAS-FOF were assessed by reviewing the distribution of scores graphically depicted in a histogram.

Reliability of VAS-FOF was measured by test-retest reliability, using Spearman’s rank correlation coefficient between VAS-FOF at baseline and VAS-FOF at one week.

The strength of agreement was defined as fair (0.20-0.50), moderate (0.50-0.70) and substantial (>0.70).\(^{26}\)

Construct validity was tested by examining the correlations between VAS-FOF and EQ-VAS-QoL. Concurrent validity of the VAS-FOF was tested by comparing VAS-FOF with the FES-NL and SAFFE-NL. Correlations were expected to be substantial, since all three instruments claim to measure FOF. All correlation coefficients were calculated by Spearman rank correlation coefficient \(r_s\).

Concurrent validity was also tested by comparing literature-based predefined mutually exclusive subgroups. We formed subgroups based on age, gender, serious consequence of fall and number of fall incidents in the past twelve months. The median scores and IQR for VAS-FOF, FES-NL and SAFFE-NL were determined for each of these groups. Differences between groups were tested using the Mann-Whitney U test, \(p \leq 0.05\) was considered statistically significant.
RESULTS

SUBJECTS
During the inclusion, 941 patients were seen in the A&E department after a fall; 186 patients were excluded because they did not meet the inclusion criteria. Of the remaining 755 patients, a fall questionnaire was sent to 650 patients (Figure 1). The 105 patients that did not receive a fall questionnaire had already filled out the questionnaire once before. In total, 440 patients (68%) returned their questionnaires and were included in the analysis; 328 patients were reached for follow-up. The reasons 112 patients were left out of analysis at follow-up: not reached by phone (n=35), unwillingness to participate (n=5), deafness (n=4), admittance to another hospital or nursing home (n=21), inability to understanding questions (n=6), death (n=1), incomplete baseline data (n=9) and administrative issues (n=31) (Figure 1). Of these contacted, 314 patients were able to complete the telephone-administered VAS-FOF. Table 1 shows baseline characteristics of the 440 respondents who returned their questionnaire. Comparison with the data of non-responders showed that non-responders were significantly older (80.1 yrs ± 8.3) than patients who returned the questionnaire (76.8 yrs ± 7.5; p=0.02). Sex was equally distributed in both groups (68% female). Although more non-responders were admitted to hospital after the fall (31.2% versus 23.9% in the responders group), this difference was not significant (p=0.2).

FOF
The median VAS-FOF score (n=432) was 2 at baseline (quartiles 1-6) and 3 (quartiles 1-6) one week later. These scores were significantly different (p=0.05). The distributions VAS-FOF scores were asymmetrical, with a large peak at 1. At baseline, 45.7% of the patients had a minimum score of 1, which decreased to 27.5% at follow-up.

The FES-NL score (n=363) showed that 41.4% of the patients were not worried (a total score of 0) that they would fall while performing certain activities (median 0, IQR 0-4). The SAFFE-NL (n=341) showed that 14.1% of the patients would never avoid activities (a total score of 17) because of FOF (median 23, IQR 18-32). For the
other scores, score-distributions of VAS-FOF, FES-NL and SAFFE-NL were rather equally distributed.

**RELIABILITY**
Test-retest reliability for the VAS-FOF was 0.56 (p=0.01). At follow-up, 35% of the patients gave a higher score on VAS-FOF than at baseline, while 40% gave the same score. This difference between baseline and retest VAS-FOF was significant (p=0.05).

**VALIDITY**
At baseline, 393 patients gave a score on the VAS-QoL. Spearman’s correlation between VAS-FOF and VAS-QoL was -0.37 (p=0.01) at baseline, indicating that an increased FOF is associated with decreased QoL.

Correlations between VAS-FOF and FES-NL and SAFFE-NL were fair with an rs 0.44 and rs 0.48 respectively.

Subgroup analyses are shown in Table 2. Older patients had significantly more FOF, except when assessed with FES-NL. Female patients were more afraid of falling; only for VAS-FOF, this difference was significant. Patients with a serious consequence of the fall were more afraid of falling, but this difference was not significant for any questionnaire. Recurrent falling made patients more afraid of falling according to VAS-FOF, FES-NL and SAFFE-NL.

**DISCUSSION**
In this study, psychometric properties of a point VAS-FOF in community-dwelling older people, who visited the A & E department after a fall, were investigated. Test-retest reliability coefficient at a 1-week interval was moderate at .55. Validity coefficients were fair to moderate: -0.37 for correlation with VAS-QoL, 0.42 for correlation with FES-NL and 0.48 for correlation with SAFFE-NL.

In terms of test-retest reliability, 35% of the patients had a higher score on the VAS-FOF at follow-up than at baseline suggesting that FOF is a dynamic and subjective construct. Correlations between measures of a dynamic phenomenon at
different points in time (when it is likely that the phenomenon has changed) present limitations to the inference of reliability.\textsuperscript{19} The test-retest approach was probably not suitable for a reliability evaluation of VAS-FOF. Also, since data were collected by two different means, a self-administered survey and an interviewer telephone-administered survey, the mode of administration may have influenced the patients’ responses. A review by Bowling\textsuperscript{27} suggests that interviewer-administered surveys elicit more positive and socially desirable responses than self-completed surveys.

Earlier research showed decreased QoL to be one of the consequences of FOF.\textsuperscript{1-3,5,13} We also found significant correlations between FOF and QoL. As expected, these correlations were only fair. QoL is not only influenced by FOF, but also depends on various physical, psychological, functional and social aspects.

Concurrent validity of VAS-FOF, measured by correlations with FES-NL and SAFFE-NL, was moderate. A possible explanation could be that VAS-FOF, FES-NL and SAFFE-NL measure different constructs. The FES-NL is used as a measure of perceived self-efficacy at avoiding a fall during basic activities of daily living\textsuperscript{21}, while the SAFFE-NL assesses FOF, activity and activity restriction\textsuperscript{13}. These specific designs raise the question whether these instruments really measure FOF. Also, FES-NL refers almost exclusively to very basic activities of daily living. It does not include more demanding or complex activities that may be relevant for older people with higher functioning. It seems likely that the subjects from our study perform more activities outside, since 60.6\% performs physical activities (half an hour walking, cycling or swimming) at least three times a week. The correlation between FES-NL and SAFFE-NL of 0.65 (p<0.01) also suggests that these two instruments do measure the same construct. However, it seems likely that the construct of FOF and the construct of self-efficacy at avoiding a fall, as measured with the FES-NL, are related, as are the construct of FOF and the construct of avoiding activities, as measured with SAFFE-NL. Our study did not identify these relationships, presenting a possible limitation to the validity of VAS-FOF. However, psychometric properties of FES-NL and SAFFE-NL are only moderate, which could help explain this lack of relationships.
Further evaluation of the validity of VAS-FOF with subgroup analyses showed that FOF is positively correlated with age, except when using FES-NL. This result supports findings in earlier research \(^4,^{11,13,23,28}\), as does the relationship we found between recurrent falling and FOF.\(^1,4,11-13,16,23,29\) Our study suggests that the VAS-FOF can discriminate between groups differentiated by age and fall history. The VAS-FOF also identified a positive correlation between FOF and gender, further confirming previous studies.\(^9,11,16,23,29,30\)

If the fall had serious consequences, patients were more afraid of falling, according to both VAS-FOF and SAFFE-NL, although none of these relationships achieved statistical significance. A possible explanation is that patients with extremely serious consequences of the fall were admitted to the ICU or the Department of Neurology, excluding them from this study. It is fair to assume that these patients are very fearful of falling.

This study has several limitations. Patients must be able to conceive the VAS-FOF as representation of a personal perception of an abstract concept, namely FOF. Another dilemma involves the lack of experiential grounding for the maximal descriptor: ‘no fear’ is easily understood by patients, whereas ‘extreme FOF’ has no absolute value and could be thought of as immeasurable. The number selected to best reflect the intensity of FOF experienced depends on the patients’ unique interpretation of the maximal value. Furthermore, the VAS-FOF has limited ability to discriminate in the lower regions of the scale: patients who have no FOF are not clearly discerned from patients slightly afraid of falling.

This study has other limitations. Patients with cognitive impairment were excluded from this study. This might limit generalization to the whole population of older persons living in the community. Also, the investigated population is patients, for whom the fall and/or the consequence of the fall were serious enough to visit the A&E Department. Thirdly, non-responders in this study were mostly patients aged 80 years and over. Given that age is a risk factor for FOF\(^5\), not receiving data from these older adults might have positively influenced FOF measured in our sample. Finally, the VAS-FOF is a one-dimensional scale, used to measure the multi-dimensional construct of FOF.
In conclusion, our study supports the use of the VAS-FOF as an easy to apply instrument to measure FOF. In daily clinical practice, a simple and easy to fill-in instrument that requires little motivation of the rater or patient is needed to measure FOF. The VAS-FOF could supply for this need, since the VAS-FOF provides a convenient, easy, and rapidly administered measurement strategy. Further research can contribute to further psychometric soundness of the VAS-FOF. Then, the natural course of FOF can be investigated, as well as results of multifactorial interventions on FOF. This all can, eventually, contribute to decrease FOF and the number of fall incidents and to better QoL, especially for older, more vulnerable persons.

Key points
- Fear of falling (FOF) is a common and potentially serious problem in older adults living in the community and associated with negative behavioural consequences, including recurrent falling and overall lower quality of life.
- Many different instruments to measure FOF have been developed. An instrument for measuring FOF that has not been investigated yet, is a Visual Analogue Scale for Fear of Falling (VAS-FOF).
- Fear of falling was significantly associated with higher age, female gender and having a history of more than one fall.
- Our study supports the use of the VAS-FOF as an instrument to measure FOF.
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FEAR OF FALLING IN OLDER PATIENTS

**FIGURE 1**
**PATIENTS AGED 65 YEAR AND OLDER VISITING THE A & E DEPARTMENT AFTER A FALL BETWEEN MAY 1, 2007 AND JULY 16, 2008**

- Patients seen in the A & E Department n=941
- Eligible to participate n=755
- Fall questionnaire n=650
- Return of questionnaire and included in the study n=440 (68.0%)
- Excluded patients n=186
  - cognitive impairment n=73
  - admittance ICU n=16
  - admittance Neurology n=73
  - language problems n=14
  - death within 24 hours n=8
  - living in nursing home n=2
- No fall questionnaire because of second episode n=105
- Patients excluded from follow-up n=112
  - not being reached by phone n=35
  - not willing to participate n=5
  - being deaf n=4
  - admittance to hospital or nursing home n=21
  - not understanding questions n=31
  - death n=1
  - incomplete baseline data n=9
  - administrative reasons n=31

314 patients (95.7%) completed telephone-administered VAS-FOF
### TABLE 1
**Baseline characteristics of elderly (n=440) patients seen in the A & E Department after a fall**

<table>
<thead>
<tr>
<th>Demographic</th>
</tr>
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</table>
| Age (years, mean, sd)                | 76.8 (7.5)  
| Female, n (%)                        | 299 (68.0)  
| Social status, n (%)                 |  
| Married/living together              | 229 (52.0)  
| Widowed/divorced                     | 163 (36.1)  
| Single                               | 44 (10.0)   
| Unknown                              | 4 (0.9)     
| Living arrangement, n (%)            |  
| Home alone without help              | 207 (47.0)  
| Home alone with help                 | 206 (46.8)  
| Senior residence                     | 22 (5.0)    
| Unknown                              | 5 (1.1)     
| Physical activity, n (%)             |  
| Daily                                | 208 (47.3)  
| Three times a week                   | 81 (18.4)   
| Weekly                               | 29 (6.6)    
| Monthly                              | 5 (1.1)     
| Never                                | 110 (25.0)  
| Unknown                              | 7 (1.6)     
| First fall vs. having fallen before, n (%) |  
| First fall                           | 195 (44.3)  
| Recurrent fall                       | 241 (54.8)  
| Unknown                              | 4 (0.9)     
| Fractures after fall, n (%)          |  
| Hip fracture                         | 4 (12.3)    
| Wrist fracture                       | 40 (9.1)    
| Ankle fracture                       | 12 (2.7)    
| Vertebra fracture                    | 4 (0.9)     
| Other fractures                      | 96 (21.8)   
| Multiple fractures                   | 30 (6.8)    
| No fracture                          | 203 (46.1)  
| Unknown                              | 1 (0.2)     
| Hospitalization due to fall, n (%)   |  
| Hospitalization                      | 105 (23.9)  
| No hospitalization                   | 333 (75.7)  
| Unknown                              | 2 (0.4)     

### TABLE 2

<table>
<thead>
<tr>
<th></th>
<th>VAS-FOF</th>
<th>FES-NL</th>
<th>SAFFE-NL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>by telephone</td>
<td>by telephone</td>
<td>by telephone</td>
</tr>
<tr>
<td><strong>n</strong></td>
<td><strong>p-value</strong></td>
<td><strong>n</strong></td>
<td><strong>p-value</strong></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65-79 yrs.</td>
<td>281</td>
<td>1 (1-5)</td>
<td>216</td>
</tr>
<tr>
<td>≥ 80 yrs.</td>
<td>151</td>
<td>5 (1-8)</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>138</td>
<td>1 (1-5)</td>
<td>107</td>
</tr>
<tr>
<td>female</td>
<td>294</td>
<td>3 (1-7)</td>
<td>&lt;.001*</td>
</tr>
<tr>
<td><strong>Serious consequence of fall</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>serious</td>
<td>251</td>
<td>3 (1-6)</td>
<td>1821</td>
</tr>
<tr>
<td>not serious</td>
<td>180</td>
<td>1 (1-6)</td>
<td>.21</td>
</tr>
<tr>
<td><strong>First fall vs. recurrent fall</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>first</td>
<td>194</td>
<td>1 (1-3)</td>
<td>149</td>
</tr>
<tr>
<td>recurrent</td>
<td>235</td>
<td>5 (1-8)</td>
<td>&lt;.001*</td>
</tr>
</tbody>
</table>

*p ≤0.05

VAS-FOF=Visual Analogue Scale for Fear of Falling; FES-NL=Dutch translation of the Falls Self Efficacy Scale
SAFFE-NL=Dutch translation of the Survey of Activities and Fear of Falling in the Elderly
Box 1

**Visual Analogue Scale for Fear of Falling (VAS-FOF)**

Are you afraid to fall? (please tick the appropriate box below)

1 2 3 4 5 6 7 8 9 10

not afraid  very much afraid
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Reference List


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27 Bowling A. Mode of questionnaire administration can have serious effects on data quality. *J Public Health (Oxf)* 2005 Sep;27(3):281-291.

