The reliability and predictive accuracy of the falls risk for older people in the community assessment (FROP-Com) tool

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Abstract

Background: the Falls Risk for Older People in the Community assessment (FROP-Com) tool was designed for use in targeted multi-factorial falls prevention programmes. It fills the gap between the short screening tools and the longer assessment tools, e.g. the physiological profile assessment (PPA). The aim of this study was to determine the reliability and predictive accuracy of the FROP-Com.

Methods: the intra-rater and inter-rater reliability studies were performed with 20 participants each. The prospective study was performed with 344 community-dwelling older people presenting to an emergency department after a fall and being discharged directly home. Following a home-based assessment, including the FROP-Com, Timed Up and Go (TUG) and functional Reach (FR), participants were monitored for falls for 12 months.

Results: the intra-class correlation coefficient (ICC) for intra-rater reliability and inter-rater reliability for the FROP-Com was 0.93 (95% CI 0.84-0.97) and 0.81 (95% CI 0.59-0.92) respectively. The AUC for the FROP-Com was 0.68 (95% CI 0.63-0.74). At the cut-off 18/19, sensitivity was 71.3% (95%CI 64.4-78.3) and specificity was 56.1% (95% CI 48.9-63.4). The AUC for the TUG was 0.63 (95% CI 0.57-0.69) and for the FR was 0.60 (95% CI 0.54-0.66).

Conclusion: the FROP-Com demonstrated good reliability and a moderate capacity to predict falls.

Keywords: accidental falls, aged, geriatric assessment, risk factors, elderly

Introduction

Targeted multi-factorial falls prevention programmes have been recommended as one of the most effective approach to preventing falls in older people [1]. The cornerstone of such programmes is the multi-factorial falls risk assessment that identifies an individual’s risk factors for falls, so that these can be targeted with suitable management.

A few falls risk assessment tools for community-dwelling older people have been developed and validated, specifically for multi-factorial programmes. Most published tools are designed for screening and therefore do not cover the number of risk factors required in a full falls risk assessment [2-4]. Other tools have not had predictive accuracy results published, e.g. the Falls Assessment Proforma [5]. One tool that has been studied in more detail is the Physiological Profile Assessment (PPA) [6]. It assesses multiple risk factors; however, it does not include key risk factors such as medications and cognition, and is unlikely to suit the needs of assessors looking for a more simplified tool. There is a clear need for a multi-factorial falls risk assessment tool that includes a range of modifiable risk factors, can classify falls risk, is simple to use and provides direction for further assessment and intervention.

The Falls Risk for Older People in the Community (FROP-Com) was developed at the National Ageing Research Institute to fill this gap in 2001. The FROP-Com can be used by any health professional in emergency departments (EDs), primary care, hospital outpatient clinics and private homes. It was modified from the Falls Risk for Hospitalised Older People (FRHOP) to suit the community. Selection of the items on the FRHOP was based on research of risk factors at the time, and advice from an expert group. The FRHOP, in the sub-acute hospital setting, has
been found to have good levels of reliability and moderate prediction accuracy [7].

The FROP-Com covers 13 risk factors in 26 questions with either dichotomous or ordinal scoring, from 0 to 3. A total of these individual scores provides an overall score of falls risk, ranging from 0 to 60, with higher scores indicative of greater risk. The factors included in the FROP-Com are contained in Appendix 1 in the supplementary data on the journal website http://www.ageing.oxfordjournals.org. The tool includes guidelines on (1) scoring each risk factor and (2) guidelines on suitable evidence-based referral/interventions. The full FROP-Com takes 10–15 min to complete and requires no equipment. The FROP-Com and its guidelines are available at http://medwh.unimelb.edu.au/research/research_falls_service.htm.

The aims of this study were to evaluate the reliability, concurrent validity and predictive accuracy of the FROP-Com in a sample of older people at high risk for falls.

Methodology

Study design and participants
The studies on the reliability, concurrent validity and predictive accuracy of the FROP-Com were nested within a randomised controlled trial (RCT). Participants for the RCT were recruited from older fallers from the EDs of seven hospitals in Melbourne, Australia. The ED staff at participating hospitals identified potential participants. The inclusion criteria for the RCT were being aged 60 years or older, living in the community, having presented to an ED as a result of a fall, being discharged directly home following emergency care and being able to walk independently. A fall was defined as an unexpected event in which the participants come to rest on the ground, floor, or lower level [8]. All participants received the usual care from the ED staff, including referral to potential falls prevention services. The project was approved by the Human Research Ethics Committees at the participating hospitals.

Reliability of the FROP-Com
As many as 20 consecutive consenting participants from one hospital took part in the intra-rater reliability study and 20 consecutive consenting participants from a second hospital took part in the inter-rater reliability study. The inclusion criteria for the reliability studies were participation in the RCT and well versed in functional English.

Concurrent validity and predictive accuracy of the FROP-Com
In all, 344 participants randomised into the control arm of the RCT were included in the concurrent validity and predictive accuracy studies. Participants not completing the 12-month follow-up period and not sustaining a fall prior to ceasing participation were withdrawn.

Validity of the FROP-Com

Data collection
Participants were assessed in their homes after discharge from the ED either by a physiotherapist, occupational therapist or medical doctor, depending on assessor availability. At this home visit the following data were collected and tests administered:

- Demographics.
- Most severe injury sustained in the index fall.
- Usual care potential falls prevention services put in place by the ED staff: including referrals to falls and balance clinic, physiotherapy and occupational therapy.
- FROP-Com.
- Two measures of mobility/balance previously found to be associated with falls [9–12]:
  - (i) Timed Up and Go (TUG) [13]. When assessing the TUG at the home visit, the closest possible to a standardised chair was used.
  - (ii) Functional Reach (FR) [12, 14].

Reliability of the FROP-Com
For the intra-rater reliability study, a physiotherapist performed all of the initial assessments and then returned to the participant’s house 2 weeks later to repeat the FROP-Com. For the inter-rater reliability study, a physiotherapist or a doctor performed the initial and repeat assessments. In the second visit, 1 week later, the other clinician was blinded to the initial results.

Concurrent validity and predictive accuracy of the FROP-Com
The correlation study was performed by comparing the FROP-Com score to the TUG, FR, HAPAAS and MFES scores collected during the home-based assessment.

The predictive accuracy of the FROP-Com was assessed by comparing the FROP-Com score at the home visit to no falls/one or more falls sustained by the participants over the subsequent 12 months. Participants were asked to record the occurrence of falls in a falls diary. All participants were telephoned every 2 months to verify the information recorded in the falls diary. Those not returning their diary were telephoned to obtain their falls information. A research assistant collected all of the 12-month falls data and did not refer back to the assessment results.

Analysis
Descriptive analyses were used for all demographic and baseline assessment data, using STATA (Version 8).
Reliability of the FROP-Com

To determine the intra-rater and inter-rater reliability of the overall FROP-Com score, intra-class correlation coefficients (ICC) and 95% confidence intervals (95% CI) were calculated. ICC (3,1) was used to determine the intra-rater and ICC (2,1) was used to determine inter-rater reliability [17].

The reliability of the individual items in the FROP-Com was assessed using percentage agreement and weighted Kappa [18, 19].

Concurrent validity and predictive accuracy of the FROP-Com

For normally distributed variables, Pearson’s $r$ was used to analyse correlation and significance acquired using Fisher’s exact method. For non-normally distributed variables, Spearman’s $\rho$ was used and 95% CIs were calculated using the bias-corrected bootstrap method [20].

To determine the predictive accuracy of the FROP-Com area under the receiver operating characteristic (ROC) curve (AUC) was calculated. The cut-off point between low and high risk was chosen at the point with the highest Youden’s index (sensitivity + specificity − 1) [21] and sensitivity above 70%. This sensitivity level was set to ensure that the tool was clinically useful. AUCs were calculated for the TUG and FR, and compared to the FROP-Com using roccomp in STATA.

The ROC analysis was repeated for the outcome of recurrent (two or more) falls in the 12-month follow-up period. ROC analysis was also repeated for the subset of participants not receiving potential falls prevention services in their ‘usual care’ from the ED. Analysis of differences in baseline characteristics between the participants receiving versus not receiving potential falls prevention activities as part of their usual care services was performed using t tests, comparison of proportions and Fishers exact.

Results

Reliability of the FROP-Com

The characteristics of the participants in the reliability studies are shown in Table 1. The ICC for intra-rater reliability for the FROP-Com was 0.93 (95% CI: 0.84–0.97), and for inter-rater reliability was 0.81 (95% CI: 0.59–0.92). The mean individual item Kappa statistic for intra-rater reliability was 0.63 (95% CI: 0.52–0.73), and for inter-rater reliability was 0.57 (95% CI: 0.46–0.68). For individual item Kappa statistics, see Appendix 1 in the supplementary data on the journal website http://www.ageing.oxfordjournals.org.

Concurrent validity and predictive accuracy of the FROP-Com

Participants were recruited for the evaluation of the predictive accuracy of the FROP-Com study between January 2003 and December 2005. The flow of the participants into the study is included in Figure 1.

For the 344 participants, the home-based assessment occurred as a median of 27 days after ED discharge (inter-quartile range: 19–44). Home-based assessments were performed by a physiotherapist (54.7%), an occupational therapist (12.5%) or a medical doctor (32.8%). The average age of participants was 75.9 (95% CI: 75.0–76.8) and 69.2% (95% CI: 64.3–74.1) were female (Table 1). The average score for the normally distributed FROP-Com was 19.6 (95% CI: 18.9–20.3). The most common usual care falls prevention service put in place prior to the home-based assessment was physiotherapy [17.2%, (95% CI: 13.3–21.6)] (Table 1).

The correlation coefficient, Pearson’s $r$, between the FROP-Com and FR was 0.50 (95% CI: 0.42–0.58), and between the FROP-Com and HAPAAS was 0.68 (95% CI: 0.62–0.73). Spearman’s $\rho$ between the FROP-Com and non-normally distributed TUG and MFES was 0.62 (95% CI: 0.54–0.68) and 0.54 (95% CI: 0.42–0.58) respectively. For all correlations there was statistically significant evidence against the null hypothesis of independence of the assessment tools ($P<0.001$).

Of the 344 participants, 164 (47.57%) fell in the 12-month follow-up period. The AUC from the ROC for the FROP-Com, was 0.68 (95% CI: 0.63–0.74) (Figure 2). Youden’s index was highest (0.30) at the cut-off of 20/21, with 166 (48.3%) of the 344 participants classified as high risk. At this cut-off, the sensitivity was 65.9% (95% CI: 58.6–73.1) and specificity was 64.4% (95% CI: 57.4–71.4). However, with a sensitivity above 70%, a cut-off of 18/19 may have more clinical value. At a cut-off of 18/19, the sensitivity was 71.3%...
Falls as the outcome, the AUC for the FROP was 0.69 more falls in the 12-month follow-up period. With recurrent and TUG/FR.

A significant difference was found between the FROP-Com and FR (AUC: 0.62; 95% CI: 0.55–0.68) improved slightly. No services, the AUC of the FROP-Com remained the same limited to the participants not receiving the usual care services (Table 1). With the predictive accuracy analysis TUG and FR scores than participants receiving usual care falls prevention services had significantly better FROP-Com, had a significantly higher AUC than the TUG (AUC: 0.60 (95% CI: 0.54–0.66). The FROP-Com was 68.2% (95% CI: 60.7–75.7).

Of the 344 participants, 100 (29.1%) sustained two or more falls in the 12-month follow-up period. With recurrent falls as the outcome, the AUC for the FROP was 0.69 (95% CI: 0.63–0.75). The FROP was a significantly stronger predictor of recurrent falls than the FR (AUC: 0.62; 95% CI: 0.55–0.68, P = 0.03), but not the TUG (AUC: 0.62; 95% CI: 0.58–0.70, P = 0.07).

**Discussion**

The FROP-Com, developed for use in multi-factorial falls prevention programmes, is simple to use and provides guidelines for management. In this group of older fallers presenting to an ED after a fall, significant correlation was found between the FROP-Com and measures of balance and mobility, physical activity and falls efficacy. The intra-rater and inter-rater reliability ICCs for the FROP-Com were high. The FROP-Com had a moderate capacity to predict falls and with the full sample of control participants, the FROP-Com was a stronger predictor of falls than the TUG and FR. However, when the sample was limited to those not receiving usual care potential falls prevention services, the difference was no longer statistically significant.

The clinical significance of the finding of the FROP-Com being or not being a statistically significantly stronger predictor of falls than the TUG and FR across the different samples in this study, needs to be considered. Firstly, across...
the different samples there are very small changes in the predictive accuracy (AUCs and 95% CIs) of the tools. Secondly, the aim of this comparison and the concurrent validity study was to assess if the FROP-Com was associated with falls and other commonly used tools. These results do not indicate any of these tools should be used over the other as the FROP-Com, a comprehensive multi-factorial assessment tool, meets needs very different from the TUG and FR. Overall, the results indicate that the FROP-Com is as good a predictor as the TUG/FR and an appropriate tool to investigate falls risk when a comprehensive falls risk assessment tool is required.

Strengths and weaknesses of this study
The findings of this study should be interpreted in the context of the potential limitations. Previous studies have reported the high falls risk of patients sustaining falls and presenting to EDs [5, 22]. The high-risk profile of the participants would require the tools to be more sensitive to smaller differences in falls risk level than if a wider range of falls risk levels were present in the sample. This may result in an underestimation of the predictive accuracy of the tools in this study compared to previous studies [9–11]. All participants were community-dwelling older people who sustained a fall prior to joining this study. Hence, these results cannot be extrapolated to community-dwelling non-fallers or people living in residential care.

Comparison to other studies
Few other published studies of predictive accuracy for multi-factorial FRATs are available for comparison. However, comparison can be made to screening tests that have predictive accuracy data published. In development studies, Pluijm and colleagues [4] and Tromp and colleagues [23] report their screens to have AUCs of 71%. However, the capacity of a combination of risk factors to predict falls will always be higher in development studies when multiple combinations of factors are trialed. Nandy and colleagues found the falls risk assessment tool to have a Youden’s index of 0.39. This is a higher Youden’s index than found for the FROP-Com in this study. However, across the different populations it is a parsimonious comparison and the falls risk assessment tool, assessing only four risk factors, meets a different clinical need than the FROP-Com.

Impact of this study
The FROP-Com was found to be reliable and a moderate predictor of falls in this high falls risk sample. The FROP-Com has the advantage over many of the currently published tools as it covers multiple risk factors for falls, and grades the severity of these factors. It provides guidelines for management based on the individual risk factors and an overall score of falls risk, yet is simple to administer.

Future research direction
Prior to recommending the FROP-Com for clinical use it requires validation in a different population, and the guidelines for management require further assessment.
Key points
The FROP-Com is a comprehensive falls risk assessment tool that covers 13 risk factors for falls, gives a score of severity for individual risk factors and overall falls risk, is designed for use in targeted multi-factorial intervention programmes and is simple to use. The FROP-Com was found to have a good level of intra-rater and inter-rater reliability. The FROP-Com correlated well with tests of balance/mobility, physical activity questionnaires and falls efficacy questionnaires in a home based falls risk assessment. At the best cut-off, the FROP-Com successfully predicted 71.3% of fallers and 56.1% of non-fallers in this high falls risk sample of older people. In the full sample of 344 participants in this study, the FROP-Com was a significantly stronger predictor of falls than the FR and TUG.

Validity of the FROP-Com

In the full sample of 344 participants in this study, the FROP-Com successfully predicted 71.3% of fallers and 56.1% of non-fallers in this high falls risk sample of older people. The FROP-Com was found to have a good level of intra-rater and inter-rater reliability.

The FROP-Com correlated well with tests of balance/mobility, physical activity questionnaires and falls efficacy questionnaires in a home based falls risk assessment.

At the best cut-off, the FROP-Com successfully predicted 71.3% of fallers and 56.1% of non-fallers in this high falls risk sample of older people.

In the full sample of 344 participants in this study, the FROP-Com was a significantly stronger predictor of falls than the FR and TUG.

References


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Conflicts of interest
None

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Supplementary data
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