Validation of a falls risk assessment tool in the sub-acute hospital setting: a pilot study


ABSTRACT
Falls are a common problem for older people in hospital and can negatively impact on health outcomes. This pilot study aimed to investigate the reliability and predictive accuracy of a newly developed multidisciplinary assessment tool – the "falls risk for hospitalised older people" (FRHOP) and to compare the prediction accuracy of the FRHOP with the "St Thomas’s risk assessment tool in falling elderly inpatients" (STRATIFY). Forty patients aged over 65 were recruited from five wards in a sub-acute geriatric hospital. Participants were assessed either once only as part of the prediction study or twice as part of the reliability study. Assessments were conducted by trained project staff including a podiatrist, occupational therapist, physiotherapist and a prosthesis. Incident Report Forms were reviewed after discharge to identify participants who fell during their current hospitalisation for the prediction study. There was a broad range of risk factors identified, with total falls risk scores ranging from 10 to 35 (mean 20.6 (SD 5.8)]. Among the risk factors identified, 48% of participants had one or more foot pathologies and only 18% had footwear that met pre-determined criteria for appropriate footwear. Both retest and inter-rater reliability of the FRHOP were high [ICC (2,1) =0.95 and 0.85 respectively]. Seven participants fell (16%), two falling more than once. Using the total number of risk factors rated as high risk, a cut-off score of four or more yielded a sensitivity of 57% and specificity of 68%. The STRATIFY had a sensitivity of 43% and specificity of 43%. The FRHOP is a reliable falls risk assessment tool with moderate levels of prediction accuracy. Further validation with a larger sample is warranted.

INTRODUCTION
Falls among older people were acknowledged as one of four key priority areas by the Australian Government in its 2001-2003 National Injury Prevention Plan. While the majority of falls prevention research and program activity to date has focussed on older people in the community setting, falls have been shown to be an even greater problem for older people in hospital, where pre-existing falls risk is compounded by acute illness and an unfamiliar environment.

Falls risk assessment is a common feature of hospital falls’ prevention programs and involves a brief review of key falls risk factors in order to quantify falls risk; to identify specific falls risk factors; and to provide a framework for informing decisions about intervention options. There have been several recent reviews of falls risk assessment tools in the hospital setting. These have highlighted the small number of risk assessment tools that have been validated in the hospital setting. A number of criteria were developed by the falls prevention project team at Melbourne Extended Care and Rehabilitation Service (MECRS) to determine the potential usefulness of existing falls risk assessment tools. These included:

- providing a broad review of the most common falls risk factors for older people;
- an ability to identify an individual’s risk factors and to target interventions to these;
- an ability to grade falls risk from minimal to high. Falls risk is cumulative, so that presence of an increased number of risk factors increases an individual’s risk of further falls.
- This can apply even if there is only a mild risk of falling on a number of risk factors, as they may add up to a moderate overall risk;
- an ability to identify need for referral to services not routinely accessed by all in-patients within their hospitalisation (eg podiatry and dietitians); and
- an ability to be incorporated into routine clinical practice without excessive strain on current assessment/documentation procedures by staff.

It was also considered important that the documentation involved in falls risk assessment actually influenced actions and outcomes, and was perceived by staff to do so. Otherwise it can be seen as just another piece of documentation and another burden on already limited staff time.

STRATIFY is a brief falls risk screening tool, one of the few that have been validated in the hospital setting. It consists of only five risk factors (presenting with a fall or fall on the ward; agitation; visual impairment; frequent toileting; and transfer

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and mobility), and a score of two or more indicates a high risk for falls. The STRATIFY tool has been shown to have moderate to high accuracy in classifying falls risk in aged care units in an acute hospital in London, and in a 500 bed community hospital.6 A recent study evaluating the STRATIFY in a Geriatric Assessment and Rehabilitation Unit in Canada identified lower levels of prediction accuracy.1 Similarly other tools such as the Morse Scale, the Falls Risk Assessment Tool by Schmid, the Conley Scale, and the High Falls Risk Model by Hendrich et al., have all been applied in the hospital setting with moderate to high prediction accuracy.6,11,12,13,14 However, each of these could be considered a brief screen, rather than a comprehensive falls risk assessment tool. A comprehensive multidisciplinary falls risk assessment tool has been described by Patrick et al, which included seven falls risk factors with each risk factor graded on three levels.15 Evaluation of this tool in a rehabilitation setting identified that a primary diagnosis of stroke was the only factor able to accurately discriminate fallers from non-fallers, however the tool was not subjected to prediction accuracy analyses.16 These studies highlight that there has been little research evaluating the accuracy and reliability of comprehensive falls risk assessment tools in the hospital setting that can guide clinical decision making. Most falls risk assessment tools that have been reported have “unclear derivations, arbitrary weightings, and have not been prospectively validated.”17

To address this need, the FRHOP risk assessment tool was developed (Figure 1).18,19,20 The FRHOP includes a broad range of falls risk factors supported by the research literature. Most of the individual risk factors are graded from nil (0) to high (3) risk and a list outlining targeted interventions for each risk factor is provided. At MECRS, and a number of other sub-acute settings, many of the items on the FRHOP are already assessed by members of the multidisciplinary team, which potentially reduced the additional amount of assessment required. The tool is also accompanied by a referral form designed to support decision making for referral to professional groups who do not routinely see all patients on admission to the sub-acute setting, such as podiatrists and dietitians. The guidelines associated with the FRHOP encouraged staff to address each risk factor irrespective of the total falls risk score. Although the form was designed to be completed by four disciplines in the sub-acute setting (nursing, medical, physiotherapy and occupational therapy), it has the potential to be completed by one staff member.

The primary aims of the current study were to investigate the reliability (retest and inter-rater) and predictive accuracy of the FRHOP in a sub-acute setting, in the context of routine care, and to compare the prediction accuracy of the FRHOP, a comprehensive risk assessment tool, with the STRATIFY, a brief screening tool.1 In addition, the profile of falls risk identified by the FRHOP for sub-acute patients was also investigated.

**METHOD**

**Participants**

Volunteers were recruited from new admissions to the five in-patient wards at MECRS from December 5, 2001 to June 12, 2002 (four Geriatric Evaluation and Management wards and the Rehabilitation Unit). Recruitment involved a two-tiers process, a requirement for ethics approval. Physiotherapy or nursing staff not involved in the study made initial contact with patients (or next of kin/guardians for all patients with an Abbreviated Mental Test Score [AMTS] of less than seven), to obtain signed expressions of interest in being involved in the project. Signed expression of interest forms were forwarded to the project staff who then sought written consent. Assessment/s were then arranged by the project officer.

Inclusion criteria for the study were being aged 65 or older, and able to speak English or Italian. The rationale for inclusion of Italian speaking patients was to increase the generalisability of the study results, as Italian is one of the most common non-English community languages spoken in the catchment areas of MECRS. The Plain Language Statement and consent form were translated into Italian and an Italian interpreter was available to be utilised in the assessment process if required.

The study aimed to recruit 120 patients. Based on falls figures in the hospital it was estimated that this sample size would provide sufficient numbers in the analysis of fallers. However only 46 patients consented to be involved in the study during the study time-frame, and only 44 completed the assessment process (one participant died, and one had an in-patient fall necessitating transfer to an acute hospital prior to assessment). Time and resource constraints did not allow extension of the recruitment phase. Factors considered to contribute to the low recruitment rate included the two-tier recruitment process (described above), the limited interest in research by patients just admitted to a new hospital setting, poor health status, difficulty accessing next of kin/guardians if the patient had cognitive impairment, and a moderate proportion of patients with a primary language other than English or Italian. There were 26 male (59%) and 18 female

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**Table 1: Demographic profile of participants in the retest and inter-rater reliability studies, and for the predictive validity components of the study.**

<table>
<thead>
<tr>
<th></th>
<th>Inter-rater study</th>
<th>Re-test study</th>
<th>Predictive study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants</td>
<td>12</td>
<td>12</td>
<td>44</td>
</tr>
<tr>
<td>% male</td>
<td>25%</td>
<td>50%</td>
<td>59%</td>
</tr>
<tr>
<td>Average age (SD)</td>
<td>82.3 (9.6)</td>
<td>77.3 (6.7)</td>
<td>79.8 (7.3)</td>
</tr>
<tr>
<td>(Age Range)</td>
<td>(69-101)</td>
<td>(64-87)</td>
<td>(64-101)</td>
</tr>
<tr>
<td>AMTS &gt; 7</td>
<td>11 (92%)</td>
<td>12 (100%)</td>
<td>35* (80%)</td>
</tr>
<tr>
<td>English preferred language</td>
<td>11 (92%)</td>
<td>11 (92%)</td>
<td>37 (84%)</td>
</tr>
</tbody>
</table>

*One Abbreviated Mental Test Score (AMTS) score was missing.*

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Note: The mean age and male/female ratio at MECRS during the study period for all new admissions aged 65 plus was 85 (SD 8.2) and approximately 64% (females) respectively.
(41%) participants in the study ranging in age from 64 to 101, with a mean age of 79.8 years (SD 7.3). Seven (16%) participants were non English speaking (Italian). These 44 participants represented only 7.9% of admissions to MECRS aged 65 years and older during the validation study period.

**Procedures**
The study consisted of two discrete components – the reliability phase (inter rater and retest reliability) and the prediction phase. The reliability component aimed to evaluate how consistently the same assessor on two consecutive days (retest reliability), and two different assessors on the same day (inter rater reliability), rated a person’s risk of falling using the FRHOP. The prediction phase aimed to investigate the tool’s ability to accurately classify an individual’s falls risk. At the end of the project, research staff reviewed Incident Report Forms, which were completed by ward staff whenever an adverse event such as a fall occurred, to identify participants in the prediction component of the study who fell during their hospitalisation. Table 1 provides the demographic profile of the 12 participants in the retest reliability study component; the 12 participants in the inter rater reliability component; and the 44 participants in the prediction component of the study.

Participants were assessed either once only, as part of the prediction study where both the FRHOP and STRATIFY were administered (n=20), or twice, either as part of the retest reliability (and the prediction phase) (n=12) or inter rater reliability (and the prediction phase) (n=12). No patient was assessed as part of all three components – prediction phase, retest reliability, inter rater reliability – as this was considered to be excessive given the age and frailty of many of the participants.

<table>
<thead>
<tr>
<th>Table 2: Proportion of sample of predictive study with “high risk” reported for the risk factors assessed.</th>
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</thead>
<tbody>
<tr>
<td>Criteria for classification of high risk (rating = 3)</td>
</tr>
<tr>
<td>Has the patient fallen recently?</td>
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<tr>
<td>Did they sustain an injury as a result of a fall in the past 12 months?</td>
</tr>
<tr>
<td>Is the patient on any medication?</td>
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<tr>
<td>Does the patient take any medication associated with increased risk of falling?</td>
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<tr>
<td>Does the patient have a chronic medical condition/s affecting their balance &amp; mobility?</td>
</tr>
<tr>
<td>Does the patient have an uncorrected sensory deficit/s that limits their functional ability?</td>
</tr>
<tr>
<td>Cognitive impairment (AMTS&lt;5)</td>
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<tr>
<td>Incontinence</td>
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<tr>
<td>Has the patient’s food intake declined in the past three months due to a loss of appetite, digestive problems, chewing or swallowing difficulties?</td>
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<tr>
<td>Weight loss during the last 3-12 months.</td>
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<tr>
<td>Observed behaviours in Activities of Daily Living &amp; Mobility indicate:</td>
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<tr>
<td>Footwear problems</td>
</tr>
<tr>
<td>Were the patient’s scores on the Timed Up and Go test and the Functional Reach test within normal limits?</td>
</tr>
<tr>
<td>Is the patient independent in transferring and in their gait? (Includes wheelchair mobility)</td>
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<tr>
<td>AMTS: Abbreviated Mental Test Score</td>
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</table>
Assessments were generally conducted within four to seven days of admission by one of the four project clinicians trained in the use of the tool. Assessors included a physiotherapist, occupational therapist, podiatrist and prosthetist. Although the assessors were all MECRS staff, assessments were arranged so that they were performed by assessors who did not have any clinical involvement with the individual patient. Assessment findings were conducted independent of routine assessments and management by ward staff. For the purposes of the study, assessment results from the FRHOP were not conveyed to ward staff.

The assessment process involved obtaining information from the patient’s medical records; clinical progress notes; drug charts; and other information in patient medical histories. Where information was not available in any documentation, information was obtained by talking to the patient, the patient’s next of kin/guardian or ward staff. Assessment also included two balance tests and two somato-sensory tests. The balance tests included the Timed Up and Go test (time taken to stand up from a chair, walk three metres, turn around, return to the chair and sit back down again) and the Functional Reach test (maximal distance able to be reached forward from standing upright with the arm elevated in front at 90° shoulder flexion). The somato-sensory tests included proprioception (joint position sense) of the great toe, and light touch sensation of the foot. For proprioception, the participant was asked to close his or her eyes and the assessor grasped the great toe on the medial and lateral sides and dorsiflexed or plantarflexed the toe in a random order. The participant was asked to report the direction that the great toe was moved. Amputees were automatically noted as having proprioception loss. Light touch sensation of the foot was assessed using a 5.07/10gram Von Frey monofilament. Seven standardised sites were tested for each foot (ensuring that all dematomes were assessed) in a random order, with the participant’s eyes closed. The participant indicated the location of the monofilament if this could be felt. It has been suggested that a deficit in more than half of the sites used for sensory testing is indicative of peripheral neuropathy. If participants were unable to sense the monofilament on four or more sites they were classified as having sensory loss. A deficit in either of the proprioception or light touch tests was reported as a ‘yes’ response on the assessment form for somato-sensory deficit.

Training was provided by a physiotherapist in relation to the balance tests and by the project geriatrician in relation to the somato-sensory testing. Other training for assessors included: the identification, of footwear features and common foot diseases by the project podiatrist; detailed explanations of observed Activities of Daily Living (ADL) categories by the project occupational therapist; and weight loss by a dietitian associated with other aspects of the project. Assessors were provided with an assessment kit that included: detailed guidelines for completing the FRHOP; Von Frey filaments for the somato-sensory testing; a stop watch, tape measure and three metre string for the balance tests; a copy of the MIMS medication booklet; and a summary list of falls risk medications and safe medications.

Statistical analysis

Frequency analyses were performed for each item of the FRHOP. Differences between fallers and non-fallers for each risk factor were analysed using Chi Square Test. Retest and inter-rater reliability for the total FRHOP score was established using IntraClass Correlation Coefficients [ICC (2,1)], while weighted Kappa was used to assess reliability of individual items on the FRHOP. Predictive accuracy was assessed using sensitivity and specificity analyses.

RESULTS

The primary diagnoses leading to admission at MECRS for the 44 participants included: falls/fall related injuries (31.8%); multiple medical conditions (15.9%); stroke (9.1%), urinary or bowel conditions (6.8%); amputee rehabilitation (6.8%); fractures (4.5%); cardiac conditions (4.5%); and other (20.5%). Table 1 details the demographic profile of participants. Although the study sample represents only a small percentage of hospital admissions during the study period, the age and range of admission diagnoses in the study sample generally reflect the broad mix of older patients admitted to MECRS.

There was a range of risk factors identified in the 44 assessments conducted as part of the predictive phase. Most risk factors were graded scoring a 0 indicating no risk/absence of the risk factor, 1 for low risk, 2 for moderate risk or 3 for high risk. The total falls risk score for the 44 participants ranged from 10 to 35 (the FRHOP total score ranges from 0 to 45) (Figure 2). The mean total score was 20.6 (SD 5.8) (median =

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**Figure 2: Distribution of FRHOP total risk scores.**

![Distribution of FRHOP total risk scores](image-url)
All participants had some degree of falls risk. The proportion of participants rated at high risk on each falls risk factor is shown in Table 2. Of note, there were three risk factors where over 40% of participants were rated at high risk, including four or more medications (91%), three or more inappropriate footwear features (43.2%), and marked balance impairment to the level of requiring physical assistance to perform the tests (45.5%). The distribution of scores on the STRATIFY are shown in Figure 3. Scores were distributed across the full range of available scores (0-5).

Frequent toileting was the only risk factor where a significantly greater proportion of fallers had the risk factor present than non-fallers. Other risk factors including dementia, amputation, hearing loss and incontinence had a strong trend for a greater proportion of fallers to have the risk factor than non-fallers.

To provide an example of the distribution of risk on specific falls risk factors, foot pathology and footwear will be discussed in more detail. Foot pathology leading to pain has been associated with impairment in standing and walking. Foot pathology is a common clinical observation in older patients, with epidemiological studies placing the prevalence as high as 86%, and older people tend to under report their level of foot pathology. Forty eight percent of participants in this study had one or more foot pathologies. Foot pathologies consisted of: corns (n=4); bunions (n=5); ulcers (toe or heel) (n=3); calluses (n=3); toe amputation (n=2); painful joints; swollen feet; pathological/onychauxic nails (n=2); and digital deformities.

Footwear has been shown to impact on postural stability, with studies showing that around 47% of older people do not wear what would be considered to be stability enhancing footwear. There is still some debate in the literature as to what characteristics of a shoe will impact most on postural stability, however for the purpose of this study, a shoe was considered to be appropriate if it was: well fitting; had a heel less than 2cm high and greater than 3cm wide; had a fastening mechanism (lace, Velcro or buckle); a rigid heel counter; was flexible across the metatarsal break; and had non slip tread patterns on the soles. Only 18% of participants had footwear that met the above criteria and was deemed to be appropriate, with most (63.6%) participants wearing slippers or other inappropriate footwear types. Almost half (43%) of the participants wore footwear that failed to meet three or more of the above characteristics associated with appropriate footwear and an additional 39% had footwear with one to two inappropriate features (Figures 4 and 5).

In this small sample of participants, presence of foot problems (yes/no) and inappropriate footwear (yes/no) did not differ significantly between fallers and non-fallers (although the small number of fallers limits this analysis) (χ²=0.05). In relation to inappropriate footwear 43% of both fallers and non-fallers had footwear with three or more inappropriate footwear features (Figure 5). Use of slippers was common, with around half of all participants wearing these at the time of the assessment, and contrary to expectations, slipper use was significantly more common in non-fallers.

Reliability accuracy
The reliability coefficient for the total falls risk score was high for both the retest [Intraclass Correlation Coefficient (ICC 2,1)=0.95 [95% CI 0.84 – 0.99] and inter-rater reliability [ICC 2,1=0.85 [95% CI 0.55 – 0.95]. Correlation of individual FRHOP items were generally slightly lower than the overall risk score and ranged from Kappa of 0.4 to 1.0 (average 0.81) for the retest assessments and from 0.21 to 1.0 (average 0.52) for the inter-rater assessments. Most items scored above 0.75 on the retest component which represents excellent agreement, and between 0.4 and 0.75 on the inter-rater reliability study, which represents fair to good agreement. Where there was disagreement, assessments generally varied by one level only.

Prediction accuracy
Seven participants fell (16%) during their hospitalisation, two participants falling more than once. The prediction accuracy of the FRHOP was analysed using two methods, the total falls risk score and the number of risk factors identified as high risk
A number of cut-off scores were used to evaluate which yielded the best predictive outcome.

Using the first method, the total falls risk score, the highest level of sensitivity (correctly predicted the patient would fall) achieved was 43%, with a specificity level (correctly predicted the patient would not fall) of 68%, using a cut-off score of 23 and over. Higher sensitivity scores were achieved with lower cut-off scores (71% using 19 as a cut-off score and 57% using 21 as a cut-off score), however both resulted in lower specificity scores (58% and 46% respectively). Using Receiver Operator Curve (ROC) graphs to identify the best sensitivity/specificity mix, as identified by the area below the graph, the cut-off score of 23 resulted in the best mix (area under curve = 0.55).

The second method used to evaluate prediction accuracy of the FRHOP was to use a classification based on the number of individual risk factors that were rated three points, indicating high risk. There were ten risk factors with a graded risk score ranging from 03 and two risk factors (incontinence and sensory deficits) that totalled three points if all three categories were present. Therefore there were 12 risk factors that could score three points. Using this method of analysis the highest level of sensitivity achieved was 57%, with a specificity level of 68%, using four or more risk factors rated three points as the cut-off score. This method had a slightly higher level of prediction accuracy than the previous method. A higher sensitivity score was achieved by using a cut-off score of two or more risk factors rated as three points (86%) however, the specificity level was only 16%.

Using ROC graphs to identify the best sensitivity/specificity mix, the cut-off score of four or more risk factors rated three points resulted in the greatest area under the curve of 0.62.

Using a number of cut-off scores to trial the predictive accuracy of the STRATIFY in the sub-acute setting the highest level of sensitivity achieved was 43%, with a specificity level of 43%, using a cut-off score of two or more. Higher cut-off scores resulted in lower levels of sensitivity (29% for cut-off scores of three, four or five), but higher specificity (81%, 95% and 100% respectively).

Based on the frequency distribution, and the sensitivity and specificity analyses for the FRHOP and STRATIFY, cut-off scores for differing falls risk were analysed. For the FRHOP, low falls risk was defined as 9-14 (14% of participants), moderate falls risk was defined as 15-22 (52% of participants), and high falls risk defined as a score of 23 or more (34% of participants). For the STRATIFY, a cut-off score of two (as recommended by the tool developers) resulted in 54.5% of patients being classified at high risk.

DISCUSSION

The FRHOP has been shown to have high overall retest and inter-rater reliability in the sub-acute setting, and to have moderate predictive accuracy of risk of falling. In a setting where there is moderate to high levels of risk across a broad range of risk factors, a tool such as the FRHOP has a number of additional benefits when compared to briefer falls risk screening tools, such as the STRATIFY. The FRHOP includes a comprehensive range of risk factors providing a framework for staff to consider targeted options to reduce risk on each of the risk factors identified. The tool and the accompanying list of strategies facilitate staff decision making, ensuring that all relevant risk factors are being considered for intervention.

Given that most patients in the sub-acute setting have some level of falls risk, a system of grading risk enables consideration of strategies to address even mild levels of risk on some risk factors, which otherwise may not be identified as risk factors if a dichotomous (yes/no; present/absent) scale was used. If simple strategies can reduce mild risk on several risk factors, this may potentially reduce future overall risk for that individual.
Grading of level of risk on individual risk factors, and then subsequently on overall level of falls risk, provides information to guide clinical decision making regarding the suitability of more costly/less available resources, such as bed alarms, hi-lo beds, sitter, or other avenues for increased surveillance. Using a tool like the STRATIFY classified 55% of participants (limiting its utility for this specific purpose), whereas the FRHOP classified 34% as high risk.

The FRHOP also provides a multidisciplinary approach both to assessment and management ensuring that each risk factor is examined and addressed by a staff member with the most appropriate skills rather than simply applying generic interventions. The detail in a tool such as the FRHOP enables a more focused discussion between disciplines in team meetings and provides structured avenues and referral mechanisms to a broad range of other services not routinely accessed by in-patients. Even if assessment was to be conducted by one discipline, the FRHOP ensures that multidisciplinary interventions are considered.

There is also a growing recognition of the need for including falls risk information in discharge planning. The FRHOP, in its detailed identification of individual risk factors, provides an opportunity for better continuum of care planning so that the aim of the assessment process is no longer simply to prevent a fall during the current hospitalisation.

The identification of specific falls risk factors also highlight areas to be included in individual patient education. For example, the high prevalence of foot pathologies and inappropriate footwear determined during the validation of this tool, highlights the importance of advising patients to receive regular care for foot pathologies and to wear footwear that improves stability in order to prevent falls. Recent studies have highlighted the foot problems that are common among older people and the influence of footware on stability.5,10-12,14,15,16-20 To further assist clinical practice, Menz and colleagues developed both footware and foot pathology assessments. The Footwear Assessment Form was reported to be reliable in assessing shoe type, heel height, heel counter stiffness, longitudinal sole rigidity and tread pattern, however there was low agreement in relation to shoe hardness. The Foot Problem Assessment form was reported to have very high reliability for each specific foot condition and the total number of observed conditions.5 The authors also found that specific foot problems impaired performance in more challenging balance tests and in some functional tests, and foot pain was found to be a significant independent predictor of performance in each of these tests. Further research investigating the most appropriate footware and footcare to minimise falls for older people in hospital is warranted.

Effectively introducing a tool such as the FRHOP, or any other assessment tool, into routine clinical practice requires consideration of a number of key factors. These include: the provision of adequate staff training (several sessions, covering all shifts and disciplines, using several formats) and ample opportunity for staff to ask questions and provide feedback (about concerns or methods of improving the utilisation of the form); clearly articulating roles and processes for multidisciplinary discussion of assessments and interventions, including handover processes where there are staff rotations; the conduct of occasional audits to monitor compliance and utilisation of the tool and intervention strategies (including the follow up of staff/patient non-compliance); and strong support from unit and hospital management for the assessment process.

Validating a falls risk assessment tool in a hospital setting is a challenging process, with complicating factors including short follow up period (length of stay), and the range of acute and chronic health problems of patients. In particular, sensitivity and specificity analysis can be compromised by the short length of stay factor. Studies in other settings have often used 12 months follow up for similar analysis, which is more likely to provide a true indicator of a tool’s accuracy, given the variable nature of falls events. For example, a patient with moderate falls risk may not fall during their 24 day hospital admission, but have two falls within two weeks of returning home. This patient would have been misclassified as a non-faller during their hospitalisation, but a longer period of observation would have resulted in accurate classification.

In prediction accuracy analyses such as these, there is usually a trade off between sensitivity and specificity (and positive and negative predictive values). On any falls risk assessment tool an optimal cut-off score is defined by the score which yields the greatest sum of sensitivity and specificity, and greater area under the curve in the ROC analysis eg 23 on the FRHOP. If a higher cut-off score is used, sensitivity will be lower (resulting in less accurate classification of fallers) and specificity higher (more accurate classification of non-fallers), and vice versa for a lower cut-off score. In falls prevention, particularly in the hospital setting, there may be merit in selecting a cut-off score with slightly higher sensitivity even though this will result in a lower specificity and lower positive prediction value (which will also result in a higher proportion of non-fallers being classified as fallers).11 This would, however, have resource implications if the interventions being applied were resource intensive (eg bed alarm).

There were a number of limitations that impacted on the study outcomes and generalisability. These included: the low recruitment rate; lack of representation of patients from other non English speaking backgrounds; and concurrent falls prevention activities occurring within the hospital while the predictive study was occurring. With 73% of participants having had a history of falls prior to this hospitalisation, and seven (16%) during their current hospitalisation, the concurrent activity may have resulted in a lower likelihood of falling in some at risk participants and may account for the low number of falls for the study participants. Concurrent activities included falls prevention education programs for staff, environmental safety audit review, and a nutrition audit. We are unable to estimate what proportion of participants was affected by the concurrent activities.

A relatively lower level of accuracy of falls prediction (for both the FRHOP and STRATIFY) than was originally expected can be associated with constraints of the methodology and scoring. Firstly, the two-tier recruitment process requiring hospital staff to obtain expressions of interest may have impacted on the low recruitment rate. The moderate levels of patients with cognitive impairment (consent was unable to be directly obtained) or who spoke a language other than English/Italian also impacted on recruitment levels. Secondly,
the positive preliminary finding supporting the falls risk assessment for hospital patients using the FRHOP.

ACKNOWLEDGEMENTS

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REFERENCES


