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Using targeted risk factor reduction to prevent falls in older in-patients: a randomised controlled trial

FRANCES HEALEY[1], ANDREW MONRO[2], ANGELA COCKRAM[3], VICKI ADAMS[4], DAVID HESELTINE[3]

Department of Elderly Medicine, York District Hospital, Wigginton Road, York YO31 8HE, UK
[1]National Patient Safety Agency, 4–8 Maple Street, London W1T 5HD, UK
[2]Elderly Medicine, Leeds Teaching Hospitals NHS Trust, Leeds, UK
[3]Elderly Medicine, [4]Elderly Services Team, York Health Services NHS Trust, York, UK

Address correspondence to: F. Healey. Fax: (+44) 1904 702329. Email: frances.healey@npsa.nhs.uk

Abstract

Background: falls and related injuries are known to be a significant problem for older people. There is evidence that identifying and addressing individual risk factors can reduce the incidence of falls in the community but no evidence of the effectiveness of targeted risk factor reduction methods applied to hospital in-patients.
Objective: to test the efficacy of a targeted risk factor reduction core care plan in reducing risk of falling while in hospital.
Design: a group (ward) randomised trial.
Setting: elderly care wards and associated community units of a district general hospital in the North of England.
Subjects: all elderly patients who received care in eight wards and community units during a 12-month study period.
Methods: matched pairs of wards were randomly allocated to intervention or control groups. In the intervention wards, staff used a pre-printed care plan for patients identified as at risk of falling and introduced appropriate remedial measures. Numbers of falls in each group were then compared.
Results: after introduction of the care plan there was a significant reduction in the relative risk of recorded falls on intervention wards (relative risk 0.79, 95% CI 0.65–0.95) but not on control wards (RR 1.12, 95% CI 0.96–1.31). The difference in change between the intervention wards and control wards was highly significant (RR 0.71, 95% CI 0.55–0.90, $P = 0.006$). There was no significant reduction in the incidence of falls-related injuries.
Conclusion: the use of a core care plan targeting risk factor reduction in older hospital in-patients was associated with a reduction in the relative risk of recorded falls.

Keywords: *falls, risk of falling, falls assessment, fall intervention, risk factors, falls prevention, randomised controlled trial, elderly*

Introduction

Studies consistently report that more than 30% of people over 65 years of age fall in the community each year and the numbers falling in institutions are much higher [1–3]. Injuries from falls are up to the third commonest reason for hospital bed occupancy [4]. Data on in-patient falls are limited, although they suggest that about 2% of older patients fall during their hospital admission [5]. Several major systematic reviews on prevention of falls and related injury in older people have concluded that, from community based studies, interventions targeting multiple, identified risk factors in individuals offer protection against falling, but have also noted that this type of intervention has not been sufficiently tested in a hospital setting [3, 6, 7]. This study was designed to try and address this knowledge deficit.

Methods

Background

The study took place in eight care of the elderly wards or units of a district general hospital serving a mixed urban and rural population. Two large and two smaller wards admitted acutely ill patients, either directly or after 24 hours on an admissions unit, and continued care of patients needing short-term rehabilitation. Two 'wards' were satellite units undertaking longer-term rehabilitation, respite, and terminal care; and two were specialty wards (stroke and joint psychogeriatric assessment).

Each pair of wards had identical bed numbers, skill mix, nurse staffing establishments, and patients with similar dependency levels. The design and layout of each pair of wards were almost identical. Except for occasional younger patients with multiple pathology, subjects were aged 75 years or over.

Prior to this study none of the wards carried out specific fall assessments or interventions, and investigations such as lying and standing blood pressure or ophthalmology referral occurred on an 'ad hoc' basis. There was no specialist falls clinic or other falls service available at this hospital. Environmental interventions such as cable covers and non-slip flooring in toilets and bathrooms were standard to all wards.

Design

The study wards were divided into matched pairs. In each pair, one ward was randomly allocated to control or intervention by lottery, witnessed by six health professionals. Group randomisation was used, as it would be unreasonable to expect staff to refrain from applying their knowledge of the intervention to individual patients within a particular ward.

The intervention consisted of a brief falls risk factor screen and related interventions (Table 1) in the form of a pre-printed care plan, including risk factors for falls that could be properly addressed in the hospital where the study took place. The reverse of this plan contained a brief summary of evidence, such as medication most likely to be implicated in falls, and local advice such as optical testing arrangements.

Nursing staff on intervention wards were asked to apply the intervention to patients admitted with a history of falls, those who had fallen or had a 'near miss' during their current admission. This would not identify all patients at risk of falling, but would focus the intervention on the patients at highest risk. It was anticipated that nurses' experience of the falls care plan could affect their practice in relation to other patients, and might result in reduction of risk factors for those patients not formally identified as requiring a falls care plan. No specific training was provided – the nurses already used pre-printed care plans for other conditions, and the simple format made this unnecessary. The falls care plan was interleaved with accident reporting forms already in routine use on the wards throughout the study period, to prompt its use when 'near misses' or falls occurred. The study did not attempt to measure or enforce use of the care plan for all appropriate patients.

Managers on control wards were made aware of the study, and the need not to introduce the care plan in their area. Control wards made no other changes to practice or environment relevant to falls prevention during the study. Whilst nurses instigated the process, remedial interventions were multi-disciplinary, including mobility assessment by physiotherapists and medication review by medical staff.

Data collection

The falls and injury data for the study were obtained from the hospital's Health and Safety Department (H&S) which routinely collates information from the Accident and Incident Reporting System (AIRS) forms required to be used on all wards. Data collection was effectively 'blind' since H&S staff did not know which wards were control or intervention.

Table 1. Components of the core care plan and guidelines

Health screening checklist	Targeted intervention
Eyesight – able to recognise pen/key/watch from two meters distance	If unable to recognise, optician visit if lost glasses, ophthalmology referral if no known reason for poor eyesight
Medication – check for sedatives, anti-depressants, diuretics, polypharmacy, etc.	Medical review of prescription benefit related to falls risk
Lying and standing blood pressure	Refer any deficit to medical staff. Advise patient on changing position slowly
Ward test urine	Send mid-stream urine sample if positive for nitrites, blood or protein
Difficulty with mobility	Refer to physiotherapist
Environmental check	
Review risk/benefit of bedrails for individual	Documentation of risk/benefit in nursing notes and removal or addition of bedrails as appropriate
Footwear safety	Advise relatives on replacement
Bed height	Keep at lowest height
Position in ward	Nurse patient with history of falls as close to nurses' station as possible (considering other patients' needs)
Simple environmental cause of falls (e.g. loose cable, wet floor)	Act to correct it
Nurse call bell	Explained and within reach

Routinely collected hospital information also enabled group comparisons of age, sex, primary diagnosis, and length of stay. The study lasted 12 months, with the intervention applied to the four intervention wards for the latter 6 months of the study. Data on falls and subsequent injury were analysed in four groups:

i. Intervention wards for 6 months prior to intervention.
ii. Intervention wards for 6 months during the intervention.
iii. Control wards for 6 months prior to intervention.
iv. Control wards for 6 months during the intervention.

Statistics

Power calculations indicated that 3,000 patients would be sufficient to detect, with 80% power and 0.05 significance, an intervention that reduced the risk of falls by 30%. However with the same power, this would detect only a 50% reduction (or increase) in the risk of related injuries. The study period of 12 months was chosen on the basis that slightly more than 3,000 patients would normally be admitted to the eight wards each year. The primary outcome measure was patient falls. As the number of patients and occupied bed days would not be identical in control and intervention groups, statistical analysis of the intervention was through relative risk of falling between intervention or control groups rather than absolute numbers of falls. The term 'relative risk' is more commonly used in describing the risk to an individual: it is important to clarify that in the context of this study the term was used in relation to the rate of falling between control and intervention wards. The same comparisons were also made for the secondary outcome of injuries from falls.

Confidence intervals and significance levels were calculated for appropriate pairs of groups using the formula for standard error of log (RR) given by Altman [8], and checked using SPSS. All four groups were also combined in the ratio of the two of these relative risks, measuring the improvement in intervention and control wards respectively. An extension of Altman's formula, combining the standard errors from the intervention and control relative risks, was used to calculate confidence intervals and significance levels for this overall effect.

Results

In Table 2 the control and intervention wards are compared in terms of a number of key variables. It can be seen that intervention wards had a somewhat lower 'turnover' of patients, with fewer new admissions and a slightly longer mean length of stay. Where primary diagnoses could be grouped the groups were broadly similar in percentage terms. Mean age and gender ratios were similar across both groups.

Table 3 shows the number of falls and related injuries during and after the study in the intervention and control wards. When the 6-month periods before and after the intervention are compared it can be seen that there was a reduction in the number of falls in the intervention wards but no corresponding reduction in the control wards.

Standardised figures are presented (falls per 1,000 occupied bed days) to compensate for differences in turnover between control and intervention groups.

Table 2. Comparison of the control and intervention groups of wards

	Control	Intervention
Occupied bed days[a]		
6 months before introduction of intervention	17,413	16,746
6 months following introduction of intervention	16,577	15,951
New patients		
6 months before introduction of intervention	956	776
6 months following introduction of intervention	905	749
Mean length of stay		
6 months before introduction of intervention	18.21 days	21.57 days
6 months following introduction of intervention	18.31 days	21.29 days
Primary diagnosis on admission (%)		
Respiratory disease	19	21
Cardiac disease	17	17
Cerebrovascular disease	10	8
Falls/fractures/minor injuries	8	6
Dementia/confusion	7	2
Anaemia	5	3
Parkinson's disease	2	1
Reduced mobility/ rehabilitation	2	4
'Old age'	2	1
Respite	9	8
Other	19	29
Age (mean and range)	81.2 (63–102)	81.4 (69–101)
Gender (ratio female: male)	6:4	6:4

[a]Occupied bed days = number of beds occupied at midnight × days in study period.

Table 3. Falls and related injuries in control and intervention wards

	Control	Intervention
Total number of falls		
6 months before introduction of intervention	300	240
6 months following introduction of intervention	319	180
Total injuries from falls		
6 months before introduction of intervention	77	45
6 months following introduction of intervention	62	49
Falls per 1,000 occupied bed days		
6 months before introduction of intervention	17.99	14.37
6 months following introduction of intervention	19.92	11.38
Injuries from falls per 1,000 occupied bed days		
6 months before introduction of intervention	4.42	2.69
6 months following introduction of intervention	3.74	3.07

Table 4. Relative risk of a fall occurring on any occupied bed day

	Relative risk	95% confidence limits	Significance level
Intervention: control wards			
6 months prior to intervention	0.831	0.702–0.984	0.03
6 months following intervention	0.586	0.489–0.703	<0.001
6 months after: 6 months prior to intervention			
Intervention wards	0.787	0.650–0.954	0.02
Control wards	1.117	0.955–1.306	0.17
Intervention *vs* control (ratio of relative risks)	0.705	0.550–0.903	0.006

Table 5. Relative risk of an injury occurring on any occupied bed day

	Relative risk	95% confidence limits	Significance level
Intervention: control wards			
6 months prior to intervention	0.608	0.421–0.877	0.007
6 months following intervention	0.821	0.565–1.194	0.30
6 months after: 6 months prior to intervention			
Intervention wards	1.143	0.763–1.712	0.52
Control wards	0.846	0.606–1.181	0.33
Intervention *vs* control (ratio of relative risks)	1.352	0.800–2.283	0.26

Table 4 illustrates the results of testing these comparisons by calculating the relative risk of a fall occurring on any occupied bed day. These results show that intervention wards had significantly fewer falls per bed day than control wards, both before (the risk in intervention wards was 83% of the risk in control wards) and after the intervention (the risk in intervention wards was 59% of the risk in controls).

Following the introduction of the care plan the intervention wards improved significantly (21% reduction in risk of falls) but the control wards did not change significantly (12% increase in risk of falls).

Most importantly, the change in the intervention wards was significantly different from that in control wards. The relative risk (after compared to before) in intervention wards was only 70% of that in control wards. Thus the estimated relative risk reduction in falls due to the intervention was 30%.

As Table 5 shows, there was no evidence that the intervention affected injury rates. The injury rate rose in intervention wards and dropped in control wards, although neither change was significant. The estimated overall effect of the intervention on risk was a relative increase of 35% but because of small numbers the confidence intervals were wide and the increase not significant.

Discussion

Many risk factors for falls in older people have been identified in observational studies [3, 7]. Our study was not focused on risk assessment (identifying which patients are at high risk of falls and applying generic interventions), but on targeted risk factor reduction (identifying fall risk factors that can be removed or reduced, thereby reducing the individual's risk of falling). The risk factors in this study were selected on the basis that they were practical in our hospital's acute in-patient setting, and not already consistently part of the care of patients who fell or had a 'near miss'. Routine investigations on admission would detect most causes of acute confusion associated with increased falls risk, but the care plan specified an additional check for urinary tract infections because this was a simple, inexpensive test that could be performed by the nursing staff. We had also found from prior experience that this investigation was sometimes overlooked, particularly when the fall or 'near miss' occurred after the initial acute admission. The reasons for this seemed mainly related to the practicalities of collection, for example with an incontinent patient. Some interventions were proxies for more intensive interventions offered in community studies – exercise classes were not available, but the physiotherapist would provide advice on balance and strengthening exercises where appropriate, as well as walking aids and advice on safe transfer. For ethical reasons, risk factors were not limited to those likely to produce benefits within the duration of an acute hospital stay – referral onwards of patients with eyesight problems was unlikely to produce a reduction in risk until after discharge from hospital.

The two groups in this trial shared many similar characteristics, but it is important to consider whether group differences explain the results. There were fewer new patients in intervention wards and a longer length of stay. If falls are more likely near the beginning of a hospital stay, perhaps because of unfamiliar surroundings or acute confusion, the control group would expect more falls. Conversely, if falls are less likely early on, because of an acute phase spent mainly in bed, the intervention group would expect more falls. There is limited evidence on this point. One study found that 80% of accidents (including falls) occurred within 2 weeks of admission [9]. The average length of stay in both control and intervention wards was below 3 weeks.

Primary diagnosis on admission may also influence fall rates. Clinical coding data indicated that the main disease categories were generally spread evenly between both groups (Table 2). However, significant numbers of patients in both intervention (29%) and control (19%) groups were the sole patients with a particular primary diagnosis, which limited meaningful comparison between the groups.

This study was a simple, practical, nurse-led ward intervention which was unfunded. Because of this the data collection was limited to resources already available within the hospital, which did not include data that could only be obtained through examining individual patients' medical notes. This meant that statistical analysis was not made at the individual patient level, nor was it determined how often the care plan was used, or which risk factors were most frequently targeted.

Ideally, with more resources, we would have analysed the data at the individual level. If an individual falls more than once, the independence assumption made by analysis at the group level will be affected, increasing the probability of a type 1 error (false positive). The effect of this would be to bias the standard errors and hence confidence intervals. However we believe this effect will be minor, as although it is probable that some individuals will have fallen more than once, each individual has a similar probability of falling, and it is more likely to be larger numbers of people who only fall once.

The intervention had no significant overall effect on injury rate. As only a minority of falls result in injury, large numbers would be required to detect even a substantial change in injury rate; the study was powered primarily to detect differences in the risk of falls. Therefore the absence of any effect on injury rates could be a type 2 error (false negative). It is also possible that the intervention was more effective in prevention of the more minor falls that would be less likely to result in injury.

The study took place in a normal hospital environment, with potential for staff to move between control and intervention areas, taking their awareness with them. It is not considered that this had a significant effect; the hospital had a very stable staff with no rotational schemes and low use of temporary staff. Transfer of knowledge would have been reflected in reduction of differences between control and intervention groups. This does not appear to have occurred.

The study relied on falls data collected through an established adverse incident reporting system, and therefore could have been affected by any variations in reporting over time. However, the wards shared an open, fair culture and management structure which is likely to have reduced variations between them. The incident reporting system had been in place for more than 2 years prior to the study and no changes were made to it during the study period.

We used a single piece of documentation, which could be seen as prompting and co-ordinating assessments and interventions that already commonly occur, if not consistently, on wards for older patients. Some of these interventions would not be expected to show immediate fall reduction benefits, but despite this, statistically significant reductions in fall rates were observed. Interventions with more immediate potential for risk reduction may have contributed to this, or the existence of the core care plan may have acted indirectly to increase staff awareness and ensure a clearer focus on risk factor reduction.

It is important to acknowledge that any trial of this type can produce a 'Hawthorne effect'. That is, being aware that they are part of a study can in itself alter the behaviour of participants.

Hospital patients vary widely in their individual characteristics, and it is possible for fall rates to vary because of fluctuations in the composition of the in-patient population. Therefore another possible explanation for the reduction in falls could have been natural variation rather than the intervention. However the numbers and time periods involved in this study (3,386 patients in 12 months) make this less likely.

In conclusion the use of a core care plan targeting risk factor reduction in older hospital in-patients was associated with a reduction in the relative risk of recorded falls in the intervention wards and was introduced without additional cost. Utilising existing systems of documentation, such as core care plans and accident reporting forms, may be effective in concentrating the minds of staff on the existence of fall risk factors and promoting action to remove or ameliorate them where possible.

Key points

- Falls are one of the 'Geriatric Giants'. In the older person they result in considerable morbidity, loss of independence, and as a consequence higher healthcare costs.
- Fall rates in hospital are higher than in the community, but there is little evidence on the effectiveness of multifactorial intervention programmes to reduce falls among hospital in-patients.
- This simple core care plan targeting risk factor reduction in hospital in-patients appears effective at reducing the relative risk of falls.

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Conflicts of interest

None.

Ethical approval

Obtained from York Research Ethics Committee.

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