

# Cluster randomised trial of a targeted multifactorial intervention to prevent falls among older people in hospital

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## ABSTRACT

**Objective** To determine the efficacy of a targeted multifactorial falls prevention programme in elderly care wards with relatively short lengths of stay.

**Design** Cluster randomised trial.

**Setting** 24 elderly care wards in 12 hospitals in Sydney, Australia.

**Participants** 3999 patients, mean age 79 years, with a median hospital stay of seven days.

**Interventions** A nurse and physiotherapist each worked for 25 hours a week for three months in all intervention wards. They provided a targeted multifactorial intervention that included a risk assessment of falls, staff and patient education, drug review, modification of bedside and ward environments, an exercise programme, and alarms for selected patients.

**Main outcome measure** Falls during hospital stay.

**Results** Intervention and control wards were similar at baseline for previous rates of falls and individual patient characteristics. Overall, 381 falls occurred during the study. No difference was found in fall rates during follow-up between intervention and control wards: respectively, 9.26 falls per 1000 bed days and 9.20 falls per 1000 bed days ( $P=0.96$ ). The incidence rate ratio adjusted for individual lengths of stay and previous fall rates in the ward was 0.96 (95% confidence interval 0.72 to 1.28).

**Conclusion** A targeted multifactorial falls prevention programme was not effective among older people in hospital wards with relatively short lengths of stay.

**Trial registration** Australian New Zealand Clinical Trials Registry ACTRNO 12605000467639.

## INTRODUCTION

No single intervention on prevention of falls in hospital has been proved effective in randomised trials.<sup>1</sup> Only two<sup>2,3</sup> of 13 studies in a systematic review of multifaceted programmes for falls prevention in hospital<sup>1</sup> were properly randomised trials. Both found a reduction in falls but in one trial this was only among patients with hospital stays of 45 days or more,<sup>2</sup> and the other trial had methodological problems.<sup>3</sup>

We studied a multifactorial intervention programme for falls prevention targeted at acute and rehabilitation elderly care wards in hospitals.

## METHODS

Between October 2003 and October 2006 we carried out a cluster randomised controlled trial of 24 elderly care hospital wards in 12 hospitals in Sydney, Australia.

Each was studied for three months. Pairs of wards participated consecutively over 36 months, matched for fall rates, lengths of stay, and patients' ages before randomisation (see [bmj.com](http://bmj.com)).

We included all patients in study wards during each three month study period. Research assistants collected baseline information on health, drugs, and physical function of all patients in intervention and control wards, for descriptive purposes only. They had no direct contact with patients but could not be blinded to the ward status of patients.

The study nurse saw patients in intervention wards, usually within 24 hours of admission, and carried out a falls risk assessment using a modified version of a validated tool.<sup>4</sup> On the basis of the assessment, the nurse educated the patients and their families; arranged walking aids, eyewear, modifications to the bedside environment, and increased supervision; and liaised with other staff about possible changes to drugs, management of confusion, and foot problems. She also ran education sessions for staff.

The physiotherapist saw patients referred by the nurse and ward staff. She supervised patients doing exercises. She also worked with patients to practise safe mobility within the ward and educated staff and patients and their families about this.

Alarms (see [bmj.com](http://bmj.com)) were worn by ambulant patients who staff considered unsafe to walk unsupported. A high pitched sound alerted staff that the patient was standing and required support.

Control wards had no trial interventions. Senior nursing staff were aware of the study because research assistants were collecting data.

The primary outcome was falls (see definition on [bmj.com](http://bmj.com)) in study wards during the three month study period. Information on falls was collected by research assistants from incident reports in patients' medical records, from notes in medical records, and by asking a senior nurse each day about any falls in the past 24 hours.

## Statistical analyses

We did analyses at both cluster (ward) and individual (adjusted for clustering) levels. Because pairwise matching of wards for fall rates in the three months before the study period was unsuccessful we did not take matching into account in the analyses. This failure of matching occurred because the data on falls we used for matching were routine data collected by hospitals,

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usually months old by the time the study started in a particular pair of wards. When we checked matching at the end of the study we were able to obtain data on the three month period before the study period. These are the previous data on falls that are reported in this paper and used in relevant analyses.

We used unpaired *t* tests in analyses at cluster level to compare fall rates during the three month study period in intervention and control wards, and multiple linear regression to adjust this comparison for fall rates in the three months before the study period. For analyses of fall rates at individual level we used negative binomial regression to allow for clustering of falls by the same patient, with generalised estimating equations to allow for clustering by ward, using an exchangeable correlation structure. Models were fit first without adjustment, and then with adjustment for individual length of stay and the rate of falls in the ward in the three months before the intervention. Length of stay was calculated as only the number of days a patient was in the ward during the study period. Exploratory subgroup analyses were done using a test for interaction between subgroup and intervention group.

## RESULTS

The study involved 3999 patients in 12 acute and 12 rehabilitation elderly care wards (see [bmj.com](#)). The average number of patients per ward during the three month study period was 167, 233 (range 113-332) for acute wards and 100 (range 56-170) for rehabilitation wards.

In total, 381 falls occurred during the study period. Twelve (seven on intervention wards and five on control wards) were not recorded in patients' medical records and were only identified through verbal reports from ward staff. The overall rate of falls during the study was 9.2 per 1000 bed days, with no difference between acute and rehabilitation wards (9.4 and 9.0 falls per 1000 bed days). Just over 7% of patients fell at least once: 6.1% in acute wards and 10.7% in rehabilitation wards. The most

common activities at the time of a fall were walking (36%) or standing from a sitting position (24%).

Patients in intervention and control wards had similar baseline characteristics (see [bmj.com](#)). Matching of ward pairs for previous fall rates was not successful, however, with only six pairs having previous fall rates within three falls per 1000 bed days of each other. Nevertheless, overall the average fall rates in the previous three months in intervention and control wards were similar: 8.25 and 7.62 per 1000 bed days (see [bmj.com](#)). The number of patients and mean length of stay were similar for intervention and control wards during the study (see [bmj.com](#)).

The study nurse carried out a full assessment and developed an intervention plan for 1907 (93%) of the 2047 patients in intervention wards (140 patients were not seen). The study physiotherapist did a full assessment and tailored interventions for 884 patients (43% of those in intervention wards). Alarms were recommended for 49 patients and 40 complied with their use.

Intervention and control wards did not differ in the frequency of falls, injurious falls, or fractures during follow-up (table). The mean fall rate in intervention wards was 9.26 per 1000 bed days compared with 9.20 per 1000 bed days in control wards ( $t_{22}=0.05$ ,  $P=0.96$ ). After adjusting for fall rates in the wards in the three months before the study, the mean fall rates were 9.19 per 1000 bed days in intervention wards and 9.27 per 1000 bed days in control wards ( $P=0.95$ ). The incidence rate ratios, which give the ratio of the fall rate in intervention wards to that in control wards, were all close to 1.0, with confidence intervals excluding any major effect of the intervention in all wards combined, in acute wards only, and in rehabilitation wards only (see [bmj.com](#)).

Exploratory analyses were carried out restricted to falls that occurred between 8 am and 4 pm, when study staff were most likely to be on the ward; falls that occurred in the second and third months of the intervention period, by which time usual ward staff might have become more involved in falls prevention activities; and falls occurring among patients staying in hospital more than 10 days. The intervention was not effective in any of these groups of patients (data not shown).

The intervention had no effect on rates of injurious falls (table). The unadjusted incidence rate ratio for injurious falls was 1.12 (95% confidence interval 0.71 to 1.77); adjusting for length of stay and previous fall rates gave the same result.

## DISCUSSION

A targeted multifactorial intervention for prevention of falls had no effect on fall rates in elderly care wards in Sydney hospitals. The lack of effect was evident in both acute and rehabilitation wards and occurred despite the planned interventions being successfully implemented and the alarm for selected patients being used appropriately.

A systematic review of 13 studies using multifaceted interventions in hospitals reported a pooled 18% relative reduction in falls that was just statistically

**Falls, injurious falls, and fractures during follow-up in patients in intervention and control wards. Values are numbers (percentages)**

Variable	Intervention wards (n=2047)	Control wards (n=1952)
No of falls:		
0	1890 (92.3)	1809 (92.7)
1	127 (6.2)	117 (6.0)
2	23 (1.1)	18 (0.9)
≥3	7 (0.4)	8 (0.4)
No of injurious falls*:		
0	1974 (96.4)	1894 (97.0)
1	65 (3.2)	53 (2.7)
≥2	8 (0.4)	5 (0.3)
No of fractures	2 (0.1)	3 (0.1)

\*Grazes, cuts, bruises, head injuries, fractures, dislocations, and sprains.

**WHAT IS ALREADY KNOWN ON THIS TOPIC**

Two randomised trials of older people in subacute and rehabilitation wards with long average lengths of stay suggest that multifactorial interventions can reduce the risk of falls

The efficacy of this approach in acute elderly care wards and short stay rehabilitation wards is uncertain

**WHAT THIS STUDY ADDS**

A targeted multifactorial falls prevention programme was not effective for older people in hospital wards with short lengths of stay (median seven days)

Innovative approaches to falls prevention in this setting are required

significant.<sup>1</sup> Five of the studies were randomised trials and the remaining eight were before and after studies, using historical data on falls for comparison. We consider that only two of the 13 studies were properly randomised trials of truly multifactorial interventions for preventing falls in hospital: both seemed to show a reduction in risk of falls.<sup>2,3</sup>

One of these two studies was an individually randomised trial carried out in a rehabilitation hospital in Melbourne, Australia.<sup>2</sup> The intervention comprised a risk assessment of falls, alert cards for risk of falls, exercise and education programmes, and hip protectors. The average length of stay was 30 days and the intervention was effective only among people with hospital stays over 45 days.

The other study was a cluster randomised trial involving eight elderly care wards in one UK hospital.<sup>3</sup> The randomisation was unsuccessful in producing similar preintervention mean fall rates in intervention (14.4 per 1000 bed days) and control wards (18.0 per 1000 bed days). Patients who fell while in hospital were screened for falls risk factors and appropriate interventions were then implemented. The mean length of stay was 20 days. The investigators analysed their data in an unconventional manner by calculating changes in fall rates before and during the study period and comparing the change in intervention and control wards. A 21% reduction in falls occurred in intervention wards compared with a 12% increase in falls in control wards; the difference between these changes was statistically significant ( $P=0.006$ ). In contrast, the rate of injurious falls increased 14% in intervention wards and declined by 15% in control wards; however, this difference was not statistically significant ( $P=0.26$ ).

These two previous studies might have found an effect because they had relatively long average lengths of stay (30 and 20 days). In our study the median length of stay was seven days, similar to that in most acute care hospitals. It is likely that some falls prevention interventions need more than a few days to take effect. Another explanation for lack of effect in our study is that our intervention team might have spent too little time in each ward (three months) to effect any change in

ward culture. One of the largest effect sizes in the recent systematic review was found in a study with an intervention period of two years.<sup>1,5</sup>

Strengths of our study include its large sample size, which resulted in fairly narrow confidence intervals ruling out the possibility that we might have missed a large intervention effect. The randomisation of 24 wards seems to have been successful in eliminating major systematic differences between patients in intervention and control wards. Although pairwise matching of wards by previous fall rates was not successful, the overall previous fall rates in intervention and control wards were similar. Adjusting for previous fall rates had no effect on findings.

A weakness of our study is that data were not collected blind to intervention status. It is possible that in intervention wards raised awareness of falls resulted in more diligent reporting than in control wards. Another limitation is that some falls prevention activities were already occurring in control (and intervention) wards before the start of our study. These activities would have continued during the study period, making it more difficult to show any effect of our interventions.

Our study suggests that current approaches to falls prevention in acute elderly care wards and short stay rehabilitation wards are ineffective. Prevention of falls in hospital may require innovative approaches, including improved methods for assessing cognitive impairment, use of low beds and hip protectors to prevent injury, redesign of hospital wards so that patients at high risk of falling are observable at all times by staff, 24 hour supervision of patients at highest risk of falling, and a whole system approach to ward based falls prevention led by staff that results in changes to work practice.

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**Competing interests:** None declared.

**Ethical approval:** This study was approved by the University of New South Wales human ethics committee and by ethics committees from each involved hospital.

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