Effectiveness of targeted falls prevention programme in subacute hospital setting: randomised controlled trial

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Abstract

Objective To assess the effectiveness of a targeted, multiple intervention falls prevention programme in reducing falls and injuries related to falls in a subacute hospital.
Design Randomised controlled trial of a targeted multiple intervention programme implemented in addition to usual care compared with usual care alone.
Setting Three subacute wards in a metropolitan hospital specialising in rehabilitation and care of elderly patients.
Participants 626 men and women aged 38 to 99 years (average 80 years) were recruited from consecutive admissions to subacute hospital wards.
Intervention Falls risk alert card with information brochure, exercise programme, education programme, and hip protectors.
Main outcome measures Incidence rate of falls, injuries related to falls, and proportion of participants who experienced one or more falls during their stay in hospital.
Results Participants in the intervention group (n = 310) experienced 30% fewer falls than participants in the control group (n = 316). This difference was significant (Peto log rank test P = 0.045) and was most obvious after 45 days of observation. In the intervention group there was a trend for a reduction in the proportion of participants who experienced falls (relative risk 0.78, 95% confidence interval 0.56 to 1.06) and 28% fewer falls resulted in injury (log rank test P = 0.20).
Conclusions A targeted multiple intervention falls prevention programme reduces the incidence of falls in the subacute hospital setting.

Introduction

Falls are a common occurrence among elderly inpatients in subacute hospitals and are generally reported to affect between 13% and 32% of admitted patients.[1 2] In stroke rehabilitation units, falls have been reported in up to 47% of patients.[3] Patients who fall incur physical injuries (up to 70% of falls result in injuries, 1-10% result in fractures),[4 5] psychological effects,[6] and have longer lengths of hospital stay.[5] Inpatient falls therefore result in substantial morbidity and additional healthcare costs and are a viable target for interventions.

Interventions to reduce in-hospital falls have received little attention. Only three randomised controlled trials have been published.[7–9] Two investigated single interventions (bed alarms[9] and alert bracelets[8]) in conjunction with usual care compared with usual care alone. The third investigated two interventions (additional exercise and type of flooring) in a two by two design in conjunction with usual care.[7] None of these studies showed a significant reduction in fall rates, though all the studies were relatively small (between 54 and 134 participants). Previous studies based in hospitals with historical controls and randomised controlled trials in community settings have reduced fall rates by using targeted multiple intervention strategies.[10 11] We evaluated the effectiveness of a targeted multiple intervention falls prevention programme in reducing the rate of falls, the proportion of patients who fall, and the rate of injuries related to falls in a subacute hospital.

Methods

Intervention

All patients who were consecutively admitted to the Peter James Centre from March to December 2002 were eligible for inclusion. The centre is a subacute hospital specialising in rehabilitation and care of elderly patients. There were no specific entry criteria other than referral from an acute hospital, accepted by a geriatrician. Patients ranged from 38 to 99 years, though most were over 70 years (average 80).

Participants randomised to the intervention group received a targeted falls prevention programme in addition to usual care. This programme consisted of a falls risk alert card with information brochure, an exercise programme, an education programme, and hip protectors (see bmj.com). Hospital staff used their clinical judgment to determine the need and appropriateness of each of the interventions, after administration of the Peter James Centre falls risk assessment tool (PJC-FRAT, see bmj.com). This tool has an "admission sheet" for completion by nursing, physiotherapy, occupational therapy, and medical staff to guide them in recommending various combinations of the interventions (between none and all) and an "amendment sheet" completed on an "as required" basis (see bmj.com). Interventions were initiated within three days on receipt of recommendation, informed consent, and randomisation of the participant to the intervention group.

Participants in the control group received usual care and, although the PJ-FRAT was completed, did not receive any of the interventions from the falls prevention programme. Usual care for both groups entailed weekly medical assessments, one hour sessions of physiotherapy and occupational therapy each weekday, 24 hour nursing assistance, and other allied health services when required.

Data collection

We defined a fall as "any event when the participant unexpectedly came to rest on the ground, floor or another lower level."[12] Data on falls were retrieved from hospital incident reports. Baseline measures included

ELPS *This is an abridged version; the full version is on bmj.com*

age, sex, living arrangements before admission to hospital, admission diagnostic category,[13] medical history (stroke, Parkinson's disease, cancer, congestive heart failure, osteoporosis, or a fracture related to a fall), cognitive impairment (mini-mental state examination[14] on admission), and functional dependency (modified Barthel index on admission).[13]

Blinding and analysis

The nature of the interventions prevented complete blinding of hospital staff and participants. In most cases, hospital staff who completed the PJC-FRAT "admission" sheet did not know to which group the patient had been allocated. The exception to this was in cases where the staff member was aware that a falls prevention programme intervention had been implemented based on another staff member's recommendations. Unblinding may have introduced several sources of bias, including altered practice in recording the incidence of falls or inconsistent provision of usual care. To gauge the level to which these biases may have been introduced, we conducted a survey of hospital staff (nursing, physiotherapy, and occupational therapy) eight months into the study period. Staff were asked to predict the group allocation of each participant they were caring for on that day.

We analysed primary outcomes on an intention to treat basis.

Results

Baseline characteristics

We approached 1040 patients, of whom 626 (60%) consented to participate (see bmj.com). No participants withdrew from the trial during the study period, and there were no adverse events attributable to the intervention. Baseline characteristics of participants in each group were similar (table 1).

Table 1 Characteristics of participant and completion rates of the PJC-FRAT by hospital staff. Figures are numbers (percentages) unless stated otherwise

Baseline	Control	Intervention
Mean (SD) days from admission until consent	2 (2)	2 (3)
Mean (SD) age (years)	80 (9)	80 (9)
Men	105 (33)	101 (33)
Modified Barthel index on admission (/100)*	48 (18)	47 (18)
Admission mini-mental state examination (30)*†	23 (6)	23 (6)
Diagnosis on primary admission:		
Stroke	40 (13)	32 (10)
Neurological	12 (4)	13 (4)
Elective joint replacement	44 (14)	33 (11)
Orthopaedic	95 (30)	104 (34)
Other disabling impairment	33 (10)	34 (11)
Other geriatric management	53 (17)	57 (18)
Medical history:		
Stroke	70 (22)	65 (21)
Parkinson's disease	18 (6)	18 (6)
Neoplasm	49 (16)	45 (15)
Congestive cardiac failure	40 (13)	49 (16)
Osteoporosis	36 (11)	43 (14)
Fall related fracture	55 (17)	68 (22)
Previous living:		
Home alone	120 (38)	118 (38)
Home with family	143 (45)	144 (46)
Low level residential care facility	52 (16)	47 (15)
Other	1 (0.3)	1 (0.3)
Mean (SD) length of stay after consent (days)	29 (22)	30 (22)
Mean (SD) No of attendances at hospital physiotherapy sessions	22 (17)	23 (20)
Mean (SD) days from admission to completion of discipline specific PJC-FRAT section:		
Medical	3 (5)	4 (5)
Nursing	1 (7)	1 (2)
Occupational therapy	4 (3)	4 (4)
Physiotherapy	1 (2)	1 (2)
Number of discipline specific PJC-FRAT sections not completed:		
Medical	138 (43)	112 (36)
Nursing	32 (10)	27 (9)
Occupational therapy	40 (13)	44 (14)
Physiotherapy	14 (4)	6 (2)

*Higher score better.
†25 missing values (13 control, 12 intervention) imputed by using best subset regression.

Analysis of falls, fallers, and injuries related to falls

Compared with the control group, the intervention group had 30% fewer falls (149 *v* 105) and a lower proportion of participants who experienced one or more falls (71 *v* 54), relative risk 0.78 (95% confidence interval 0.56 to 1.06). Thirty five participants in the intervention group fell once compared with 49 in the control group. Both groups had 10 participants who fell twice and three who fell three times, but the intervention group had only six participants who fell four or more times compared with nine in the control group.

The cumulative hazard estimate for both groups was similar until about day 45, when the fall rate in the control group marginally increased and the rate in the intervention group suddenly reduced (figure). Both the log rank test (P = 0.004) and Peto extension (P = 0.045) showed significantly fewer falls in the intervention group.

The incidence of falls with injury was 28% lower in the intervention group (23 *v* 32, log rank test, P = 0.20). Two participants from each group incurred a fracture related to a fall (table 2). One participant fractured the neck of the femur while wearing hip protectors.

Hospital staff survey of participant group allocation

Hospital staff correctly identified the group allocation of 90 out of 172 participants they were caring for ($\kappa = 3\%$ chance corrected agreement).

Table 2 Classification and distribution of falls that led to injury (fall rated by worst injury sustained)

Classification and description	Control	Intervention
Severe (fracture)	2*	2†
Moderate (laceration that required suturing, head injury requiring neurological observations to be taken, damage to dentures, soft tissue injury requiring radiological investigations but no fracture)	18	12
Minor (laceration that did not require suturing)	12	9
Nil (no injuries were recorded)	117	82

*One neck of femur and one shaft of femur fracture.
†Two neck of femur fractures.

Discussion

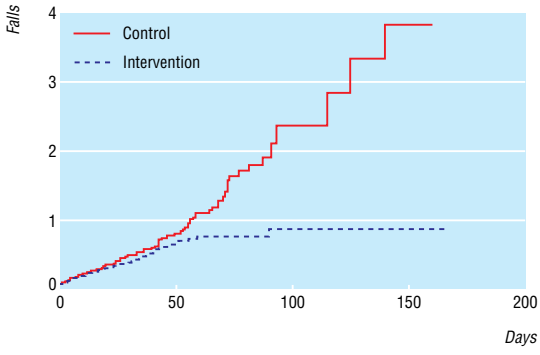
This is the first large randomised trial to show that the incidence of falls in elderly patients in hospital can be significantly reduced. The targeted multiple intervention programme we used led to a 30% reduction. A reduction of this magnitude is important not only for individual patients and their families but also for hospital management in dealing with the associated costs and additional care needed because of falls.[4–6]

In contrast with earlier studies,[7–9] we have shown that this programme had a significant effect in reducing falls, which may be because of the targeted multiple intervention strategy, where each intervention intentionally addressed one or more of various risk factors for falls. There may also have been some unintended benefits, such as increased surveillance while participants were taking part in the exercise or education programmes.

Limitations and problems

The inability to completely blind all staff and participants is a difficulty commonly encountered by researchers in the hospital setting. This may have influenced the recording of the incidence of falls or altered elements of usual care such as provision of regular physiotherapy. By randomising individual participants, variances between hospital wards in these recording behaviours should not have influenced the results. The staff blinding survey also indicated that hospital staff were relatively unaware of the allocation of participants. Lastly, attendances at the usual care physiotherapy sessions (see table 1) were similar between groups, suggesting that the provision of usual care was unaffected.

Some ethical dilemmas were present in this study. Firstly, we approached family members or carers of participants with cognitive impairment to provide consent. Although this challenges autonomy, it is important to be able to recruit participants with cognitive impairment into research that may benefit this population. Participants were not forced to participate in any intervention and were free to withdraw from the study at any stage, thus preserving a large degree of participant autonomy. Secondly, though the falls risk alert card may violate participant privacy and cause distress to participants and their families, we used a falls alert symbol identifiable by hospital staff rather than a sign with words to minimise this risk. During the study we did not receive any official complaints or requests to remove the cards.



Nelson-Aalen cumulative hazard estimates of the control and intervention groups

What is already known on this topic

Although several randomised controlled trials in community settings support the use of targeted multiple intervention programmes in reducing falls, there is little evidence of their effectiveness in hospitals

The three published trials that investigated falls prevention interventions in the hospital setting were underpowered and did not show a significant reduction in falls

What this study adds

A targeted multiple intervention falls prevention programme in addition to usual care compared with usual care alone reduced the incidence rate of falls by 30% in a subacute hospital setting

There was also a trend towards a reduction in the proportion of participants who were "fallers" and the incidence rate of fall related injuries

A targeted programme in addition to usual care leads to safer stays in hospitals for patients

Applying results

The intervention programme could potentially be incorporated into the usual care of acute, other subacute, and residential facilities for elderly people. The principle underlying the PJC-FRAT—that hospital staff recommend interventions to prevent falls on the basis of their clinical judgment—can also be incorporated into these settings. Modifications to the exercise programme in the acute setting may be required to cater for participants with drips, drains, or other attachments. The description of the nature of falls provided in the written educational material could be modified and based on data on falls from local facilities.

Our results may be generalisable to other subacute settings. Although we recruited only 60% of eligible patients, their characteristics were consistent with those of the consecutive sample of 122 patients used in the validation of the PJC-FRAT (see bmj.com), which suggests our sample was reasonably representative. Many participants in this study had diagnoses of dementia or stroke and were recommended for the falls prevention interventions, indicating that the programme could be implemented on wards that deal specifically with patients with these diagnoses. However, generalising the findings to acute hospitals may be problematic as the reduction in falls rates occurred after 45 days, a period after which few acute patients would still be in hospital.

In this study, usual care at the centre was compared with usual care plus the targeted falls prevention programme. Subsequently, we could not investigate many falls prevention interventions, such as review of sedative medication prescription, using this approach

as such interventions were already incorporated into usual care. These interventions, along with evaluation of the relative effectiveness of individual interventions from this programme and the cost effectiveness of targeted multiple intervention strategies, are worthy of further investigation.

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Medical trivia

It was late afternoon, and the professor of surgery's marathon ward round was nearing its end. He had just seen his final patient, who was recovering from a cholangiopancreatography performed that morning.

The professor turned to his house officer and asked, "What are the causes of acute pancreatitis, boy?"

"Scorpion venom, sir," quipped his houseman with a wry smile on his face. The registrar and senior house officer looked at each other with alarm as the medical students tried to suppress their giggles.

"Scorpion venom?" scoffed the professor as he peered over his glasses, which were perched at the tip of his nose. "So what is the evidence base for that, boy?"

"Er, I don't know, sir," replied the houseman, realising his glib answer had not been appreciated by the professor.

"First rule of trying to impress your boss with medical trivia is to back it up with evidence," lectured the professor.

The next week, the professorial ward round was drawing to its conclusion. At the final patient's bed the ward sister drew back the curtains to reveal a patient sitting at the edge of the bed with his head tilted forward and pinching the tip of his nose. "Sorry, I won't be a moment. I am having another one of my nose bleeds," he apologised.

The professor turned to his houseman and said, "I will ask you an easier question this week, boy. What are the causes of recurrent epistaxis?"

"Nose picking, sir," replied the houseman confidently.

The registrar and senior house officer again looked at each other with alarm. The medical students could barely contain their laughter, and even the ward sister smirked.

"Did you not learn anything from last week, boy?" bellowed the professor.

"Yes, sir, I did," replied his houseman. He continued, "Nose picking, or more accurately rhinotillexomania, is a recognised aetiology for intractable epistaxis.[1] Historically, Wilbur Leakey discovered in the 1970s the first surviving written record of nose picking in Egypt. A papyrus scroll showed financial accounts describing the payment of three heads of cattle in addition to food and lodging to Tutankhamen's personal nose picker. Another notable publication appeared in the *Journal of Clinical Psychiatry* in the mid 1990s.[2] A rhinotillexomania questionnaire was mailed to 1000 residents in Dane County, Wisconsin, in the United States. Nose picking was defined as 'the insertion of a finger (or other object) into the nose with the intention of removing dried nasal secretion.' Variables studied included time involved, levels of distress, location, technique, and methods of disposal. Shall I continue, sir?"

After a moment the professor replied, "The second rule of trying to impress your boss it not to be a smartarse."

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All the characters described are fictional, and any resemblance to any living person is entirely unintentional.

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