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Evaluation of Tailored Falls Education on Older Adults' Behavior Following Hospitalization

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

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Abstract

BACKGROUND: Older adults recently discharged from the hospital are known to be at risk of functional decline and falls. This study evaluated the effect of a tailored education program provided in the hospital on older adult engagement in fall prevention strategies within 6 months after hospital discharge.

METHODS: A process evaluation of a randomized controlled trial that aimed to improve older adult fall prevention behaviors after hospital discharge. Participants (n = 390) were aged 60 years and older with good cognitive function (greater than 7 of 10 Abbreviated Mental Test Score), discharged home from three hospital rehabilitation wards in Perth, Australia. The primary outcomes were engagement in fall prevention strategies, including assistance with daily activities, home modifications, and exercise. Data were analyzed using generalized linear modeling.

RESULTS: There were 76.4% (n = 292) of participants who completed the final interview (n = 149 intervention, n = 143 control). There were no significant differences between groups in engagement in fall prevention strategies, including receiving instrumental activity of daily living (IADL) assistance (adjusted odds ratio [AOR] = 1.3 [95% confidence interval {CI} = 0.7–2.1]; *P* = .3), completion of home modifications (AOR = 1.2 [95% CI = 0.7–1.9]; *P* = .4), and exercise (AOR = 1.3 [95% CI = 0.7–2.2]; *P* = .3). There was a high proportion of unmet ADL needs within both groups, and levels of participant dependency remained higher at 6 months compared to baseline levels at admission. The proportion of all participants who engaged in exercise following hospital discharge increased by 30%; however, the mean duration of exercise reduced from 3 hours per week at baseline to 1 hour per week at 6-month follow-up (SD = 1.12 hours per week).

CONCLUSION: Tailored education did not increase older adult engagement in fall prevention strategies after hospital discharge compared to usual care. Further research is required to evaluate older adults' capacity to change their behaviors once they return home from hospital, which may enable a safer recovery of their independence.

Keywords

evaluation studies; fall prevention; health behavior change; hospitalization; patient discharge

As the incidence of falls increases with age-related biological changes, global population aging has triggered an exponential increase of falls, fall-related injuries, and deaths worldwide.¹ Falls are a frequent adverse event among older adults recently discharged from the hospital,² and they occur in the presence of functional decline and unmet needs.³ Following hospital discharge, 14% of older adults experience falls within the first month,⁴ and more than 40% fall within 6 months.⁵ Over half of these falls result in an injury,

including head trauma and fractured hip.⁶ These posthospitalization fall rates are substantially higher than the reported annual rate of falls (30%) and injurious falls (10%) of older adults in the general community.⁷ A recent systematic review suggested interventions that have been established as effective for reducing falls in the general older population, including exercise, may not be effective for older adults recently discharged from the hospital, and further research was required.⁸

Interventions delivered around the time of hospital discharge are designed to prepare patients for their transition home.^{9,10} They are argued to reduce adverse events, such as falls and rehospitalization,^{11,12} when provided over an extended period once patients return home from the hospital¹³ and when focused on building patient capacity for selfcare.¹⁴

Education that is tailored to the older patient has been recommended for improving health behaviors and capacity for self-care during hospital-to-home transitions.¹⁵ However, the evidence of effectiveness of education for prevention of falls has been mixed.¹⁶ A ward-based falls education program reduced inpatient falls incidence by improving fall prevention behaviors on hospital wards,^{17,18} while a pilot trial of a tailored falls education program delivered prior to discharge improved fall prevention behaviors and reduced incidence of falls within the first month following hospital discharge.¹⁹ However, a recent large randomized controlled trial (RCT) that evaluated a tailored fall prevention education program delivered prior to hospital discharge found no reduction of falls or risk of falling during the 6-month period following hospital discharge.²⁰ Since the discharge intervention was designed to facilitate changes in older patients' health behaviors over an extended period after hospital discharge,^{21,22} a process evaluation was necessary to understand if the intervention had the intended effect of promoting engagement in fall prevention behaviors in the context of their life-circumstances following hospitalization.²³

The aim of this study was to evaluate the impact of a tailored falls education intervention in addition to usual care on older adult engagement in fall prevention strategies within 6 months after hospital discharge, compared to those who received a social intervention (control) in addition to usual care.²⁴

METHODS

Ethical Considerations

Ethical approvals were obtained from human research ethics committees of the participating hospitals and universities. All participants provided written informed consent prior to participation in the study. The RCT was prospectively registered in the Australian and New Zealand Clinical Trials Registry (ACTRN12615000784516).²⁰

Design

A process evaluation was conducted alongside an RCT (n = 390) that delivered tailored falls education. The intervention (patient education) provided during the RCT was intended to have the effect of reducing posthospitalization falls incidence by facilitating older adults to initiate and sustain engagement in personalized fall prevention strategies.²⁰ The protocol for this process evaluation has been previously described in detail.²⁴

Participants and Setting

Participants were patients, aged 60 years or older, from one of three rehabilitation hospitals in Perth, Australia, between August 2015 and September 2017; they were followed up for 6 months after discharge.²⁰ Patients were admitted to hospital wards with a variety of diagnoses, including stroke, recent orthopedic surgery, general surgery, or general medical conditions. Included participants had good cognition (they scored greater than 7 of 10 using the Abbreviated Mental Test Score)²⁵ and were discharged to the community.

Education Intervention

The intervention has been described in detail previously.^{20,22} The education design was based on the health behavior change theory that conceptualizes behavior change is generated from an interaction of an individual's capability, opportunity, and motivation to perform the behavior (COM-B).²⁶

The tailored education provided was a complex health behavior change intervention.²⁷ It provided knowledge (capability) and relevance (motivation) that was suited to the context (opportunity) of the individual older patient, with the aim of achieving engagement in fall prevention strategies (desired behavior changes). The COM-B framework recognizes that the desired behavior arises from combinations of any of these components of the framework, and this differs for each participant according to the context of his/her personal circumstances and recovery after hospital discharge.²⁶

The education intervention was based on a pedagogically sound program previously found to be effective for improving knowledge and motivation of older adults to engage in fall prevention strategies.¹⁹ Education was delivered by an experienced physiotherapist on a one-to-one basis at the patients' bedside while in the hospital, using a workbook, video, and individual discussions.^{20,22} Tailoring the education was a behavior change technique that involved personalizing the fall prevention strategies based on participants' experiences and preferences, followed by individualized goal setting and action planning for their imminent discharge home. The strategies promoted during the education were to facilitate a gradual and safe recovery and may have included seeking assistance with activities of daily living (ADLs), modifying home hazards, and safely completing the exercise. Following hospital discharge, once per month for 3 months, those participants in the intervention group received a coaching telephone call from the same therapist to reinforce behavior change, provide feedback, problem solve barriers to change, and modify their action plan accordingly. Those participants in the control group received a social intervention in the hospital, delivered by a different trained health professional who discussed aspects of positive aging using a scripted program at the same dose/frequency as the intervention group, without coaching telephone calls after hospital discharge. Interventions were delivered in addition to usual inpatient care, which included discharge planning for all participants and, where necessary, therapy, home visits, equipment provision, and social supports.

Outcomes and Procedure

The outcomes for the process evaluation that have previously been described²⁴ were engagement in fall prevention strategies, defined as:

- i. Formal assistance was received from a formal paid homecare provider with ADLs (eg, bathing, dressing, and eating) or instrumental ADLs (IADLs; eg, cleaning and shopping).
- ii. Informal assistance was received from family or friends with ADLs or IADLs. ADLs were defined according to the Katz Index of Independence in Activities of Daily Living,²⁸ and IADLs were defined using the Lawton Instrumental Activities of Daily Living scale.²⁹
- iii. Formal home modifications were completed, as recommended by an occupational therapist (OT), and included installation of grab rails and provision of equipment; or informal home modifications were completed by family/friends/participants themselves, including alteration of the home layout and removal of home hazards.
- iv. Exercise was completed, categorized according to supervision (by a health professional), setting (home, gym, day hospital, indoors, outdoors), and type (strength and balance, walking, hydrotherapy).
- v. Home visit was performed by an OT around the time of discharge.

Outcomes were measured by conducting face-to-face structured interviews at baseline in the hospital, then repeated at 6 months posthospitalization using structured telephone interviews.

Statistical Analysis

Data were analyzed using Stata release 15.1 (StataCorp, 2017), and an intention-to-treat analysis was undertaken. To examine potential differences between groups in demographic or clinical characteristics of the sample at baseline, unpaired between-group comparisons were conducted, including *t*-tests, Wilcoxon rank-sum tests, or χ^2 tests. Participants' level of ADL dependence was measured at baseline and 6-month follow-up using Katz scores, where 0 to 2 indicates severe dependence; 3 to 4, moderate dependence; and 5 to 6, independence.²⁸ The differences between groups in the number of participants engaging in fall prevention strategies after discharge were evaluated using mixed-effects generalized linear models with adjustment for baseline values of these variables, and results are presented as adjusted odds ratios with 95% confidence intervals (CIs). To account for potential clustering within hospital facilities, site was included as a random effect in each model. Significance was set to $P < .05$ for all inferential analyses. To examine whether findings were robust based on choice of analytical approach, a sensitivity analysis was conducted whereby generalized estimating equations with compound symmetry were used rather than mixed-effects generalized linear models. However, findings were consistent regardless of analytical approach (including similar *P* values and CIs); consequently, only the prespecified analyses were reported.

RESULTS

Participant Flow Through the Study

There were 390 participants enrolled in the RCT across three hospital sites, with 196 randomized to the intervention group and 194 randomized to the control group. Of these

participants, 4 withdrew and 4 died prior to discharge, leaving 382 participants in the discharge cohort for this study (n = 138 at site 1, n = 124 at site 2, n = 120 at site 3). The flow of participants through the study is shown in Figure 1. During the 6-month follow-up period, 48 participants (12%) were lost to follow-up, with the most frequent reason being death (30 participants). At 6 months posthospitalization, 334 participants (87.4%) were available to complete the final survey. Of these participants, 38 had been admitted to nursing homes during the follow-up period and were not available to interview, and 4 declined to complete the survey, leaving a total of 292 (76.4%) who completed the final survey for the process evaluation (n = 149 intervention, n = 143 control). Baseline characteristics of the 292 participants who completed the final survey are presented in Table 1. There were no significant differences between the two groups.

Engagement Outcomes

Table 2 presents the proportion of participants who engaged in fall prevention strategies at 6-month follow-up compared to baseline, for both intervention and control groups. There were no significant differences between groups in engagement of fall prevention strategies.

There was a 30% increase in the number of participants in both groups who received formal (paid) and informal assistance with ADLs at 6-month follow-up compared to baseline. The absence of assistance with daily activities is described as unmet needs.³ There were more than 60% of participants within both groups (intervention = 74, control = 64) who had unmet needs. Participant dependency, measured using Katz scores (0–2 = severe dependence, 3–4 = moderate dependence, 5–6 = independence),²⁸ was found to be higher in both groups at hospital discharge and 6-month follow-up, compared to hospital admission (Supplementary Figure S1).

Of participants within both groups, 40% (intervention = 79, control = 65) had not previously completed an OT home visit at baseline, and 30% of these participants went on to have an OT home visit at discharge (intervention = 43, control = 29).

Figure 2 presents exercise engagement results, including proportion of the population who were exercising at 6 months, number of hours (duration), and sessions (frequency) per week. There were no significant differences between groups in the frequency and duration of exercise undertaken. Although there were more participants in both groups (70%) who reported exercising at follow-up, most (60%) exercised for short doses of 1 hour or less per week, which was distributed over a range of two to seven sessions per week.

DISCUSSION

The study found tailored education provided in addition to usual care did not significantly increase engagement of older adults in fall prevention strategies within 6 months after hospital discharge. This lack of intervention effect was consistent with findings of the main trial.²⁰ During the 6-month follow-up period, there was a high incidence of falls in both groups (5.9 falls per 1000 patient days), reported by 42.9% of participants, and 49.7% of these falls were injurious. These results are consistent with previous studies that have

included older adults recently discharged from the hospital,^{8,15,16} in which participants are characterized by reduced function and multimorbidity.^{32,33}

Similar to previous pragmatic education evaluations,^{34,35} this trial evaluated an intervention scalable to existing hospital discharge resources.³⁶ The tailored education program was comprehensive and aimed to promote safe hospital transitions by developing participants' capability and motivation to undertake an action plan once they were discharged home from the hospital.²² The results demonstrated that the education intervention did not increase engagement in fall prevention strategies following hospital discharge, particularly exercise and assistance with daily activities, above that of usual care. This was the first trial that aimed, at the point of hospital discharge, to project change in health behaviors from the time older adults returned home from the hospital and over the 6-month recovery period. It may be that a therapist was required to provide support for participants to enact personalized action plans once they returned home.

Previous evidence has highlighted unique challenges for older adults to regain function and independence following hospital discharge^{10,37} and the difficulties of compensating for their functional limitations during recovery.^{38,39} A large proportion (66%) of participants from both groups were found to have unmet needs following hospital discharge,³ indicating they did not take the time to gradually recommence their usual daily activities in a safe manner.^{2,35,40} The presence of unmet needs in older adults may contribute to falls incidence,³ rehospitalization,^{41,42} and other negative consequences, including reduced food intake, dehydration, delirium, and pain.⁴³ Other indications that participants were struggling to regain their function during their recovery^{38,39} were in the features of their exercise engagement. Although it was encouraging to find 30% more participants in both groups were exercising at 6-month follow-up compared to baseline, over 60% exercised less than 1 hour per week, which was considerably less than their baseline level of 3 hours per week and less than recommended fall prevention guidelines of at least 3 hours per week.⁴⁴ Other indications that participants did not regain their function after hospital discharge were in raised dependency trends at 6-month follow-up compared to baseline (Supplementary Figure S1).

Although the multifactorial nature of the tailored education intervention was considered appropriate for this population of older adults recently hospitalized, the intervention may have needed to be continued in the home setting and gradually progressed over time, according to participant recovery. Previous studies have identified variable fall prevention effects when combining multiple-component interventions, such as exercise and environmental assessment and modification, and multifactorial assessment and treatment provided to high-risk older populations.^{8,45,46} Discharge-care and transitional interventions that have shown promising effects for high-risk groups involved an individualized approach that optimized patient capacity for self-care,^{13–15} and continued from the hospital to the home setting.^{47,48}

This evaluation has strengths worth noting. It was conducted according to a published protocol,²⁴ followed a large cohort for 6 months with minimal dropout, and used direct reporting from participants at baseline and followup. It followed a large RCT that utilized

robust blinding and data collection and delivered tailored education intervention as intended to a broad cohort recruited from a representative sample of rehabilitation hospitals in Australia.²⁰ There were some study limitations also. The risk of a falsenegative finding due to a smaller effect size than anticipated or a potential loss of statistical efficiency attributable to using conservative mixed-effect modeling to account for clustering is worthy of consideration. However, the sensitivity analyses indicated findings were consistent regardless of the analysis approach, indicating that the choice to include site as a random effect to account for clustering was not responsible for the nonsignificant findings.

As an evaluation that reported the impact of a fall prevention education intervention, it was important to first measure changes in participants' fall prevention behaviors. Further evaluation of the intervention's effect on participants' capability, such as whether they were knowledgeable about what they needed to do to prevent falls when leaving the hospital, is still required. In particular, further qualitative evaluation that identifies what barriers and enablers (opportunity) participants faced during their recovery over the 6 months following hospital discharge is required.

CONCLUSION

A tailored education program delivered in the hospital did not significantly change older adult fall prevention behaviors during the 6-month recovery period following hospital discharge. This was the first large-scale trial of an education intervention delivered at hospital discharge and revealed there are challenges to facilitating older adults' health behavior change once they return home from the hospital. Findings suggest that tailored education may be optimally provided over an extended period that includes when patients are in the hospital and after their return home. Further research is required to evaluate how tailored education could enable older patients to engage in fall prevention behaviors within the 6-month recovery period after hospital discharge and explore possible barriers to their engagement in the context of their life circumstances.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Sponsor's Role:

Authors S.M.M., T.P.H., M.E.M., C.E.-B., R.S., M.Z., L.F., J.F.-C., D.-C.A.L., N.W., A.B., and A.-M.H. have received a grant from the National Health and Medical Research Council (Australia) to conduct a trial that investigated how to reduce falls and promote independence in older people after hospital discharge (project application No. 1078918). C.N. received a postgraduate student stipend as part of the grant. This grant funding has not been received directly to the authors but rather to the institutions they represent. The authors have not received financial support for this study. S.M.M. receives career funding support from the National Health and Medical Research Council (Australia) (project application No. 1090440).

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Figure 1.
Participant flow through the study.

Figure 2.
Exercise engagement within 6 months of hospital discharge.

Table 1.**Demographic Characteristics of Participants**

Variable	Intervention group (n = 149)	Control group (n = 143)
Age, mean (SD), y	77.2 (8.9)	77.9 (8.4)
Female sex	90 (60.4)	95 (66.4)
Length of stay in hospital, median (IQR), d	24 (43–16)	24 (35–18)
Diagnosis		
Neurological	22 (14.7)	26 (18.2)
Musculoskeletal	23 (15.4)	20 (14)
Orthopedic	46 (30.8)	43 (30)
Cardiac or pulmonary	14 (9.4)	16 (11.2)
Other geriatric management	44 (29.5)	38 (26.6)
Visual impairment ^a	44 (29.5)	35 (24.5)
Hospital admission in 1 y prior to current	54 (36.2)	67 (46.8)
Fell in 6 mo prior to hospital admission	107 (71.8)	99 (69.2)
Fell in hospital prior to discharge	12 (8.0)	12 (8.4)
4 Medications at discharge	132 (88.6)	128 (89.5)
Psychotropic medications at discharge	43 (28.8)	40 (27.9)
Discharge destination		
Home alone	64 (42.9)	57 (39.8)
Home with partner	61 (40.9)	54 (37.7)
Home with other	16 (10.7)	29 (20.2)
Other ^b	3 (2.1)	8 (5.3)
Discharge mobility		
No aid	20 (13.4)	24 (16.7)
Walking stick	18 (12.0)	17 (11.8)
Walking frame	96 (64.4)	90 (62.9)
Wheelchair	15 (10.1)	12 (8.2)
Health-related quality of life		
GDS score, median (IQR) ^c	4 (5–2)	3 (5–2)
Depressed mood (GDS score <5)	0.2 (0.4)	0.24 (0.4)
AQoL, mean (SD) ^d	0.6 (0.1)	0.6 (0.1)
ADL function at discharge		
Katz score, median (IQR) ^e	5 (6–3)	5 (6–3)
Lawton score, median (IQR) ^f	7 (8–5)	7 (8–6)

Note: All data are given as number (percentage), unless otherwise stated.

Abbreviations: AQoL, Assessment of Quality of Life; GDS, Geriatric Depression Scale Short Form; IQR, interquartile range.

^a Glaucoma, cataracts, or macular degeneration.

^b Transitional care or nursing home.

^cScore of 5 or greater suggests depression.³⁰

^dUtility instrument.³¹

^eKatz Index of Independence in Activities of Daily Living score, with a range from 0 to 6 and a higher score indicating more independence.

^fLawton Instrumental Activities of Daily Living score, with a range from 0 to 8 and a higher score indicating more independence.²⁹

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Table 2.
Engagement in Fall Prevention Strategies within 6 Months of Hospital Discharge

Fall prevention strategies	Intervention ^a		Control ^d		Adjusted OR (95% CI), ^b P value	Coefficient (95% CI), ^c P value
	Baseline (n = 194)	6 mo (n = 149)	Baseline (n = 188)	6 mo (n = 143)		
Received formal ADL assistance ^d	31 (15.9)	52 (34.9)	23 (12.2)	47 (32.8)	1.0 (0.6 to 1.8), .8	
Frequency						0.2 (−0.3 to 0.7), .4
<3 d/wk	25 (12.9)	32 (21.5)	20 (10.6)	40 (27.9)		
3 d/wk	3 (3.0)	20 (13.4)	3 (1.6)	7 (4.9)		
Received informal ADL assistance ^e	16 (8.2)	44 (29.5)	22 (11.7)	55 (38.4)	0.7 (0.4 to 1.2), .2	
Frequency						−0.4 (−0.8 to 0.1), .1
<3 d/wk	6 (3.2)	22 (14.7)	7 (3.6)	24 (16.8)		
3 d/wk	9 (4.6)	22 (14.7)	16 (8.5)	31 (21.7)		
Received formal IADL assistance ^f	85 (43.8)	88 (59.0)	95 (50.5)	82 (57.3)	1.3 (0.7 to 2.1), .3	
Frequency						0.3 (−0.1 to 0.8), .1
<3 d/wk	84 (43.8)	78 (52.3)	94 (49.9)	76 (53.1)		
3 d/wk	0 (0)	10 (6.7)	2 (1.0)	6 (4.2)		
Received informal IADL assistance	98 (50.5)	95 (63.7)	103 (54.7)	102 (71.3)	0.7 (0.4 to 1.2), .2	
Frequency						−0.3 (−0.7 to 0.1), .2
<3 d/wk	55 (28.3)	68 (45.6)	66 (35.1)	71 (49.6)		
3 d/wk	43 (22.1)	27 (18.1)	36 (19.15)	31 (21.6)		
Completed formal home modifications ^g	114 (58.7)	87 (58.4)	123 (65.4)	77 (53.8)	1.2 (0.7 to 1.9), .4	
No., median (IQR)	1 (0–2)	1 (0–2)	1 (0–2)	1 (0–2)	0.02 (−0.2 to 0.2), .8	
Completed informal home modifications ^h	189 (97.9)	57 (39.8)	185 (98.4)	59 (39.6)	1.0 (0.6 to 1.6), .9	
No., median (IQR)	1 (1–1)	0 (0–1)	1 (1–1)	0 (0–1)	1.0 (0.6 to 1.6), .9	
Received OT home visit	78 (40.4)	95 (63.7)	62 (32.9)	89 (62.2)	1.0 (0.6 to 1.6), .9	
Completed any exercise ⁱ	73 (37.6)	111 (74.5)	79 (42.0)	101 (70.6)	1.3 (0.7 to 2.2), .3	
Sessions per week, median (IQR) ^j	5 (3–5)	4 (2–7)	5 (2–5)	3 (2–7)	−0.05 (−0.2 to 0.1), .5	
Time, mean (SD), h/wk	3.1 (1.9)	0.9 (0.9)	2.8 (2.2)	1.1 (1.3)	−0.3 (−0.7 to 0.06), .1	

Abbreviations: ADL, activity of daily living; CI, confidence interval; IADL, instrumental ADL; IQR, interquartile range; OR, odds ratio; OT, occupational therapist.

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^aAll data are given as number (percentage), unless otherwise stated.

^bAdjusted for time in study and hospital site.

^cCoefficient of change.

^dA formal paid homecare provider was provided. ADLs were defined using the Katz Index of Independence in Activities of Daily Living.²⁸

^eAssistance from family or friends.

^fIADLs were defined using the Lawton Instrumental Activities of Daily Living.²⁹

^gModifications provided by an OT.

^hUndertaken by family or friends.

ⁱIndividual or group program or walking.

^jNumber of times completed any exercise per week.