School of Physiotherapy and Exercise Science
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Tailored education for older adult fall prevention after hospital discharge

Chiara Naseri

This thesis is presented for the Degree of
Doctor of Philosophy (Physiotherapy)

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AUTHOR'S DECLARATION

I declare that this thesis is composed of my original work and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly authored works that I have included in my thesis. Signed statements of consent for inclusion of jointly authored works in this thesis were obtained from all co-authors (see Appendix A).

I have clearly stated the contribution of others to my thesis, including statistical design, survey design, data analysis, design of the intervention, professional editorial advice and any other original research work used in my thesis. The content of my thesis is the result of work I have completed since the commencement of my research higher degree candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree, diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis if any, have been submitted for another award.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The research was conducted as phases of a trial that was registered through Australian New Zealand Clinical Trials Registry (ACTRN12615000784516), and the proposed research study received human research ethics approval from the University of Notre Dame Australia (013018F), the North Metropolitan Health Service (2015_055), and Curtin University HREC reciprocally approved the research project (HR14/2016).

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1st March 2020

STATEMENT OF CONTRIBUTIONS

Contributions to Jointly Authored Works

Signed statements of consent for inclusion of jointly authored works in this thesis were obtained from all co-authors (see Appendix A).

- **Naseri, C**., McPhail, S., Francis-Coad, J., Haines, T., Etherton-Beer, C., Morris, M. E., Flicker, L., Shorr, R., Balsara, M., Netto, J., Lee, D-C.A., Waldron, N., Boudville, A., Hill, A.-M. (2017). Effectiveness of falls prevention interventions for older adults newly discharged from hospital: a systematic review protocol. *JBI Database of Systematic Reviews and Implementation Reports, 15*(3), 686-693. doi:10.11124/JBISRIR-2016-002952

Author Contributions: CN and AMH were the principal contributors to conceptualisation of the systematic review protocol manuscript after attending the JBI Systematic Review training at Curtin University of Technology February (5 days) 2016. The drafting of the manuscript was led by CN, with all authors contributing to critical revision of the manuscript.

- **Naseri, C**., Haines, T. P., Etherton-Beer, C., McPhail, S., Morris, M. E., Flicker, L., Netto, J., Francis-Coad, J., Lee, D-C.A., Shorr, R., Hill, A.-M. (2018). Reducing falls in older adults recently discharged from hospital: a systematic review and meta-analysis. *Age and Ageing, 00*, 1-8. doi:10.1093/ageing/afy043

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- **Naseri, C**., McPhail, S.M., Netto, J., Haines, T.P., Morris, M. E., Etherton-Beer, C., Flicker, L., Lee, D-C.A., Francis-Coad, J., Hill, A.-M. (2018). Impact of tailored falls prevention education for older adults at hospital discharge on engagement in falls prevention strategies post-discharge: protocol for a process evaluation. *BMJ Open, 8*(4), e020726. doi:10.1136/bmjopen-2017-020726

AMH, CN, SM and TH conceptualised the study design with ongoing expertise and support from JN, CE-B, MEM and JF-C. AMH and CN lead trial management including data collection and management and site procedure, in consultation with TH, MEM, CE-B and LF. AMH, CN and SM lead statistical analyses with support from TH, JN, D-CAL and JF-C. CN led the drafting of all sections of the manuscript in consultation with AMH, SM, JN, CE-B, MEM, LF and D-CAL. All authors critically revised the manuscript for important intellectual content and read and approved of the final version of the manuscript.

- **Naseri, C**., McPhail, S. M., Haines, T. P., Morris, M. E., Etherton-Beer, C., Shorr, R., Flicker, L., Balsara, M., Netto, J., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A.-M. (2019). Evaluation of tailored falls education on older adults' behavior following hospitalisation. *Journal of the American Geriatrics Society, 00,* 1-8. doi:10.1111/jgs.16053

AMH, CN, SMM and TPH conceptualised the study design and research protocol with ongoing expertise and support from MEM, CE-B, RS, LF, MB, JN, D-CAL, JF-C, NW, and AB. AMH and CN led trial management including data collection and management and site procedure, in consultation with TPH, MEM, CE-B, LF, NW, and AB. AMH, CN and SMM led statistical analyses with support from TPH and MB. CN led the drafting of all sections of the manuscript in consultation with AMH, SMM, MEM, D-CAL, C-EB, JF-C. All authors critically revised the manuscript for important intellectual content and read and approved of the final version of the manuscript.

- **Naseri, C**., McPhail, S.M., Morris, M.E., Haines, T.P., Etherton-Beer, C., Shorr, R., Flicker, L., Bulsara, M., Netto, J., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A-M. (2019). Older adult capability and motivation for falls prevention post-hospitalisation: evaluation of tailored education. (Manuscript number AGG-D-19_00467). Under peer review.

AMH, CN, SMM and TPH conceptualised the study design and research protocol with ongoing expertise and support from MEM, CE-B, RS, LF, MB, JN, D-CAL, JF-C, NW, and AB. AMH and CN led trial management including data collection and management and site procedure, in consultation with TPH, MEM, CE-B, LF, NW, and AB. AMH, CN and SMM led statistical analyses with support from TPH and MB. CN led the drafting of all sections of the manuscript in consultation with AMH, SMM, MEM, D-CAL, C-EB, JF-C. All authors critically revised the manuscript for important intellectual content and read and approved of the final version of the manuscript.

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AMH, CN, SMM and TPH conceptualised the study design and research protocol with ongoing expertise and support from MEM, CE-B, RS, LF, MB, JN, D-CAL, JF-C, NW, and AB. AMH and CN led trial management including data collection and management and site procedure, in consultation with TPH, MEM, CE-B, LF, NW, and AB. AMH, CN and JN led qualitative analyses. CN led the drafting of all sections of the manuscript in consultation with AMH, SMM, MEM, D-CAL, C-EB, JF-C. All authors critically revised the manuscript for important intellectual content and read and approved of the final version of the manuscript.

Contributions to Thesis as a Whole

Professor Anne-Marie Hill was the principal supervisor who conceptualised the research and was the principal investigator on the successful grant application to the National Health and Medical Research Council (Australia) (Project App no:1078918). Professor Anne-Marie Hill provided major guidance and assistance with the drafting and editing of all manuscripts and the thesis, scrutinised iterative drafts and the final document.

Professor Steven McPhail and Dr. Julie Netto were the associate supervisors who brought their expertise on conducting mixed methods research. Professor Steven McPhail also provided guidance and assistance with the design, structure, data analysis and editing of all manuscripts and the thesis.

Publication, Presentation & Awards

Published works by the author incorporated into this thesis

Naseri, C., McPhail, S., Francis-Coad, J., Haines, T., Etherton-Beer, C., Morris, M. E., Flicker, L., Shorr, R., Balsara, M., Netto, J., Lee, D-C.A., Waldron, N., Boudville, A., Hill, A.-M. (2017). Effectiveness of falls prevention interventions for older adults newly discharged from hospital: a systematic review protocol. *JBI Database of Systematic Reviews and Implementation Reports, 15*(3), 686-693. doi:10.11124/JBISRIR-2016-002952

Naseri, C., Haines, T. P., Etherton-Beer, C., McPhail, S., Morris, M. E., Flicker, L., Netto, J., Francis-Coad, J., Lee, D-C.A., Shorr, R., Hill, A.-M. (2018). Reducing falls in older adults recently discharged from hospital: a systematic review and meta-analysis. *Age and Ageing, 00*, 1-8. doi:10.1093/ageing/afy043

Naseri, C., McPhail, S.M., Netto, J., Haines, T.P., Morris, M. E., Etherton-Beer, C., Flicker, L., Lee, D-C.A., Francis-Coad, J., Hill, A.-M. (2018). Impact of tailored falls prevention education for older adults at hospital discharge on engagement in falls prevention strategies post-discharge: protocol for a process evaluation. *BMJ Open, 8*(4), e020726. doi:10.1136/bmjopen-2017-020726

Naseri, C., McPhail, S. M., Haines, T. P., Morris, M. E., Etherton-Beer, C., Shorr, R., Flicker, L., Balsara, M., Netto, J., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A.-M. (2019). Evaluation of tailored falls education on older adults' behavior following hospitalisation. *Journal of the American Geriatrics Society, 00*, 1-8. doi:10.1111/jgs.16053

Manuscripts submitted by the author for publication under peer review

Naseri, C., McPhail, S.M., Morris, M.E., Haines, T.P., Etherton-Beer, C., Shorr, R., Flicker, L., Bulsara, M., Netto, J., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A-M. (2019). Older adult capability and motivation for falls prevention post-hospitalisation: evaluation of tailored education. (under peer review)

Naseri, C., McPhail, S.M., Haines, T.P., Morris, M.E., Shorr, R., Etherton-Beer, C., Netto, J., Flicker, L., Bulsara, M., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A-M. (2019). Perspectives of older adults on barriers and enablers to engagement in fall prevention activities following hospital. (under peer review)

Other published works by the Author during candidacy not included in the thesis

Francis-Coad, J., Etherton-Beer, C., Nobre, D., **Naseri, C**., & Hill, A.-M. (2017). The effect of complex falls prevention interventions on falls in residential aged care settings: a systematic review protocol. *JBI Database of Systematic Reviews and Implementation Reports, 15*(2), 236-244. doi:10.11124/JBISRIR-2016-002938

Conference Podium presentations by Author during Candidacy period

2017

LOCAL

Mark Liveris Seminar Curtin University, *September 2017*

"To evaluate the impact of providing tailored falls prevention education for older adults at hospital discharge on engagement in falls prevention strategies"

NATIONAL

Emerging Researchers in Ageing 16th National Conference Perth, Western Australia, *November 2017*

"Interventions to reduce falls in older adults recently discharged from hospital: a systematic review & meta-analysis"

Australian Association of Gerontology 50th National Conference Perth, Western Australia, *November 2017*

"Tailored falls prevention education for older people discharged from hospital: protocol for a process evaluation"

2018

STATE

Western Australian Association of Gerontology Emerging Researchers Annual Update, *April 2018*

"Evaluation of tailored falls prevention education"

Western Australian Physiotherapy Association, Gerontology Special Interest Group Annual Research Update, *June 2018*

"Falls prevention for older people recently discharged from hospital: evidence and exploration"

"Engagement in falls prevention strategies after receiving tailored education: a process evaluation"

Curtin Ageing Research Network (CARN) Forum, *December 2018*

"Older adults' engagement in falls prevention strategies after hospitalisation a process evaluation of tailored education"

INTERNATIONAL

8th Biennial Australian and New Zealand Falls Prevention Conference, Tasmania, *November 2018*

"Falls prevention for older adults after hospital: a systematic review and meta-analysis"

"Engagement in falls prevention strategies after receiving tailored education: a process evaluation"

2019

NATIONAL

Grassroots Falls Festival, Fremantle Western Australia, *September 2019*

"Older adult's capability and motivation for falls prevention following hospital discharge"

"Barriers and enablers to falls prevention following hospitalisation: Perspectives of older adults"

Australian Physiotherapy Association Transform Conference, Adelaide South Australia, *October 2019*

"Evaluation of tailored education delivered by physiotherapists in hospital on older adult falls prevention behaviour after discharge"

"An evaluation of tailored falls education delivered by physiotherapists in hospital to facilitate older adults' engagement in exercise after discharge"

Awards & Representation by the Author

2016

- Awarded Curtin University School of Physiotherapy & Exercise Science NHMRC Scholarship #56058 to commence study under the supervision of Professor Anne-Marie Hill ($30,000 per annum tax-free for the duration of the three years doctoral study).

- Nominated as Western Australia state representative on the Australian Association of Gerontology National Student and Early Career Group.

- Awarded Scholarship ($1,500) to represent Western Australia at the 49th Annual Australian Association of Gerontology National Conference, Canberra.

2017

- Nominated as Curtin University School of Physiotherapy and Exercise Science student representative on the organising committee for the 50th National Conference of the Australian Association of Gerontology, in Perth Western Australia.

- Nominated as Western Australia student representative on the organising committee for the 16th National Conference of Emerging Researchers in Ageing, in Perth Western Australia.

2018

- Awarded Best Student Oral Presentation at the 8th Biennial Australian and New Zealand Falls Prevention Conference, Tasmania, *November 2018*.

- Interview by Reuters Health following publication of Systematic Review and Meta-analysis https://www.reuters.com/article/us-health-elderly-falls-hospital/fall-prevention-gets-harder-when-elderly-leave-hospital-idUSKCN1HB2E0

- Interview by American College of Physicians following publication of Systematic Review and Meta-analysis [Hirsch C. Review: Post-discharge home interventions can increase or decrease falls in older adults. *Ann Intern Med. 2018, 169*, JC10.doi: 10.7326/ACPJC-2018-169-2-010].

2019

- Awarded Best Early Career Research Paper Award for Gerontology at the Transform 2019 Physiotherapy Conference, Adelaide, *November 2019*.
- Awarded 2019 Mobility Travel Award for travel to Department of Aging and Geriatric Research in the College of Medicine at the University of Florida, USA in 2020

ABSTRACT

Background

Globally, falls have been identified as a major public health problem associated with population ageing. Falls are known to be increased among older adults who have been discharged from hospital and are associated with decline in function and mobility. Previous evidence of discharge interventions delivered to high-risk populations suggested a more promising falls prevention effect when they were tailored for the individuals' falls risks. An evidenced-based tailored fall prevention education program was delivered to older patients during a randomised controlled trial (RCT) (n=390) in addition to usual care. This intervention aimed to reduce falls incidence by facilitating engagement in a fall prevention action plan after hospital discharge. As the RCT was seeking to facilitate health behaviour change, it was also important to conduct an evaluation to understand the process by which the intervention affected behaviour after discharge and the mediating factors.

Aim

The aim of the research described in this thesis was to evaluate how tailored fall prevention education provided at hospital discharge in addition to usual care, affects older adults' level of engagement in fall prevention strategies during the six months after hospital discharge, compared to control conditions.

Methods

To address the gap in the evidence for effective falls prevention interventions for older people recently discharged from hospital, a quantitative systematic review and meta-analysis was first completed. The COM-B model that was used as a framework for the intervention design was subsequently used as the basis for the evaluation (Michie, van Stralen, & West, 2011). The research used an embedded mixed method design. Quantitative data for study 1 and 2 were gathered at baseline and at six months post discharge using structured surveys and

analysed using generalized linear modelling. Qualitative data for study 3 were collected using semi-structured telephone surveys for a purposive sample and analysed using interpretative phenomenological analysis. Both quantitative and qualitative data were triangulated and mapped to participants' capability, opportunity and motivation, to enable a deeper understanding of the impact of the education on their fall prevention behaviour.

Results

There were 12 high quality randomised controlled trials included in the systematic review. Analyses of overall effects of the interventions did not reveal one particular intervention was more effective than the others. However, sub-group analysis showed home hazard minimisation had a significant fall prevention effect for older patients who had a history of falls prior to hospital admission (Low Grade evidence); and nutritional supplementation for those participants who were malnourished (Low Grade evidence).

There were 76.4% participants in the RCT who completed follow-up interviews (n=149 intervention, n=143 control). Study 1 found the education intervention did not significantly raise levels of engagement in fall prevention strategies including exercise, assistance with activities of daily living (ADL) and home hazard modifications, compared to control. There were indications the overall population were struggling to regain their function after discharge, with reduced exercise doses (1 hour at follow-up compared to 3 hours at baseline, SD =1.12), and an increase in the level of assistance required to complete activities of daily living from 15% being dependent at baseline (admission) compared to 30% at six months follow-up (AOR 1.4, 95%CI 0.8-2.0, $p<0.00$). Study 2 found the education intervention enabled participants to be significantly more knowledgeable and ready to engage in fall prevention strategies earlier in their recovery at hospital discharge (-0.4, 95%CI -0.7, -0.2), $p<0.01$), and more motivated (-0.8, 95%CI -1.1, -0.5, $p<0.01$) compared to control. Study 3 explored the lived experience of a purposive sample (n=30) of participants undertaking fall prevention activities after hospital discharge, including barriers and enablers within their life-

situations during the six-month recovery period after discharge. Personal stories confirmed that some older adults have difficulty recovering their functional ability after hospital discharge. A lack of opportunity to access physical and social support after hospital was associated with apprehension and fear toward adverse events such as falls, injuries, and hospital readmission. This was represented by one participants' report "I wish someone would have told me it was going to be this difficult".

Conclusion

This was the first evaluation of a tailored fall prevention education intervention that aimed at the point of hospital discharge to prospectively change health behaviour after patients returned home from hospital. Participants who received the tailored education were found to be significantly more capable and motivated to engage in fall prevention activities earlier in their recovery, compared to control conditions, but then faced barriers to engagement after hospital discharge. This presents a clinical research imperative to understand potential gaps in health system discharge care as well as shortcomings of initiatives to support older adults during transitions from hospital to home.

This evaluation improved understanding of how older patients manage their own health as they transition from hospital to home and contributes to improving discharge and transitional care as a hospital-centred priority. The findings suggest that further tailored support that is integrated between health and community care after hospital discharge to enable older adults the opportunities to engage in strategies to improve their safety and functional ability is required.

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I feel that many paths have led to my PhD journey and that I was not the author but the subject. This journey was inspired by my desire to understand human behaviour. I have indulged my curiosity and taken the time to stretch my ear and eye to comprehend. The more I have become aware, the more I want to relate. I am thankful to my participants for lending me their valuable time and perspectives throughout this research and allowing me to be the mirror that received their light.

I will always be thankful to two key people who listened to me, then opened the door to my PhD journey and guided me along the way. To Terry Haines, who 4 years ago responded to my curiosity with an offer that left me feeling blessed and positively challenged. And to my esteemed supervisor, mentor and pillar of strength Professor Anne-Marie Hill. Words cannot describe my gratitude to you Anne-Marie. I treasure our conversations and work together, and the many times you reassured and showed me how to pragmatically jump every hurdle. I felt confident throughout this journey because I knew you would never leave me behind.

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"Now that I have laboriously accomplished my task, I will peacefully sleep and look forward to beginning a new day, knowing God is awake"

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List of Abbreviations

AMTS	Abbreviated Mental Test Score
ADL	Activities of Daily Living
AOR	Adjusted Odds Ratio
AQoL	Assessment of Quality of Life tool
COM-B	Capability, Opportunity, Motivation – Behaviour
CI	Confidence Interval
GDS	Geriatric Depression Scale
HR	Hazard Ratio
I^2	I squared statistic of heterogeneity
IRR	Incident Rate Ratio
IADL	Instrumental Activities of Daily Living
IPA	Interpretative Phenomenological Analysis
IQR	Interquartile Range
OT	Occupational Therapist
OR	Odds Ratio
RCT	Randomised Controlled Trial
RR	Risk Ratio
SEE	Self-Efficacy for Exercise scale
SD	Standard Deviation
TDF	Theoretical Domains Framework
WHO	World Health Organisation

CHAPTER 1

Introduction and Outline

1.1 Introduction

Global population ageing has triggered a greater public health focus on those segments of the older population who are at risk of declining function and care dependency (Liu-Ambrose et al., 2019). Delivery of effective clinical interventions to prevent injury and frailty in older adults has driven an innovative concept of healthy ageing in providing person-centred integrated care that maximises self-care and quality of life (Kripalani, Jackson, Schnipper, & Coleman, 2007). This concept is based on healthy ageing being more than the absence of disease. It aligns healthcare to the needs of older adults and supports them to function according to their individual goals (Tricco et al., 2017). This approach to ageing and health has been adopted by the World Health Organisation to enable everyone an opportunity to live a long and healthy life, and continue to fulfil their potential in society, regardless of their age (World Health Organisation, 2017).

The incidence of falls increases with age-related biological changes. Population ageing has seen an exponential increase of falls, fall related injuries and deaths worldwide (World Health Organisation, 2018). Falls are a frequent event among older adults who have recently been discharged from hospital (Hoffman et al., 2019), and lead to substantial healthcare costs associated with falls injuries, hospital re-admissions and extended care requirements (Burns, Stevens, & Lee, 2016; Greysen et al., 2016; Hoffman, Hays, Shapiro, Wallace, & Ettner, 2017). Older patients who are discharged from hospital have unique falls risk factors compared to the general older community-dwelling population, including a recent medical illness, change of dietary and medication regimes, and reduced functional ability (Boyd et al., 2008; Hoffman et al., 2019).

A range of effective fall prevention interventions exist for the general older community-dwelling population (Gillespie et al., 2012). A wide variety of discharge interventions have been evaluated for their efficacy in improving transitions from hospital to home, but these have not focused specifically on fall prevention (Leppin et al., 2014; Shepperd et al., 2013). There was a gap in the evidence for the older population recently discharged home from hospital, regarding effective interventions to prevent falls and falls injuries.

Despite their increased risk of falls after hospital discharge, older adults have low levels of knowledge about how to reduce their falls risks (Haines, Day, Hill, Clemson, & Finch, 2014), and low levels of engagement in fall prevention strategies during this period (Hill, A.M., Hoffmann, McPhail, Beer, Hill, K.D., Oliver, et al., 2011).

Previous research has focussed on promoting effective transitions during discharge from hospital to home. Education that is tailored to individual needs is reported to improve discharge outcomes (Gonçalves-Bradley, Lannin, Clemson, Cameron, & Shepperd, 2016), and capacity for self-care in transitioning from hospital to home (Coulter & Ellins, 2007).

The research in this thesis was conducted alongside an RCT (n=390) that represented a broad cohort of older adults recruited from three public metropolitan rehabilitation hospitals in Australia (Hill et al., 2019) (Appendix B). The trial delivered a tailored fall prevention education program in addition to usual care. It aimed to reduce the incidence of falls by facilitating engagement in a fall prevention action plan after hospital discharge. The purpose of the research reported in this thesis was to evaluate the impact of the tailored fall prevention education intervention on participants' level of engagement in fall prevention activities within six-months after hospital discharge. Using the framework of the COM-B model of health behaviour change (Michie, van Stralen, and West, 2011), this research measured participants' capability, motivation and opportunity to engage in fall prevention activities. It also explored the barriers and enablers to fall prevention engagement faced by older adults after they returned home from hospital.

1.2 Thesis Aims

The aim of the research described in this thesis was to evaluate how tailored fall prevention education provided at hospital discharge in addition to usual care, affects older adults' level of engagement in fall prevention strategies during the six months after hospital discharge, compared to control conditions. The specific objectives of the thesis were:

i. To synthesise the best available quantitative evidence of effective fall prevention interventions for older adults recently discharged from hospital, using a systematic review and meta-analysis.
ii. To measure the impact of the tailored education intervention on older adults' engagement in fall prevention strategies during the six months after hospital discharge, compared to control conditions (Study 1).
iii. To measure the impact of the education intervention on older adults' levels of capability and motivation to engage in fall prevention activities during the six months after hospital discharge, compared to control conditions (Study 2).
iv. To explore the opportunity (barriers and enablers) experienced by older adults to engage in fall prevention activities during the six months after hospital discharge (Study 3).

1.3 Thesis Structure

Chapter 2

Chapter two reports a systematic review and meta-analysis of studies that investigated the effect of fall prevention interventions provided just prior or immediately after discharge from hospital, on falls rates and falls injuries among older adults living in the community within six months after discharge from hospital. This chapter is based on two published articles.

- **Naseri, C**., McPhail, S., Francis-Coad, J., Haines, T., Etherton-Beer, C., Morris, M. E., Flicker, L., Shorr, R., Balsara, M., Netto, J., Lee, D-C.A., Waldron, N., Boudville, A., Hill, A.-M (2017). Effectiveness of falls prevention interventions for older adults newly discharged from hospital: a systematic review protocol. *JBI Database of Systematic Reviews and Implementation Reports*, *15*(3), 686-693. doi:10.11124/JBISRIR-2016-002952

- **Naseri, C**., Haines, T. P., Etherton-Beer, C., McPhail, S., Morris, M. E., Flicker, L., Netto, J., Francis-Coad, J., Lee, D-C.A., Shorr, R., Hill, A.-M. (2018). Reducing falls in older adults recently discharged from hospital: a systematic review and meta-analysis. *Age and Ageing*, *0*, 1-8 doi:10.1093/ageing/afy043

Chapter 3

Chapter three is a study protocol that describes the mixed-methods methodological design used to address the research aims and quantitative and qualitative outcomes. The chapter is based on a published article (see Appendix C).

- **Naseri, C**., McPhail, S.M., Netto, J., Haines, T.P., Morris, M. E., Etherton-Beer, C., Flicker, L., Lee, D-C.A., Francis-Coad, J., Hill, A.-M. (2018). Impact of tailored falls

prevention education for older adults at hospital discharge on engagement in falls prevention strategies post-discharge: protocol for a process evaluation. *BMJ Open, 8*(4), e020726. doi:10.1136/bmjopen-2017-020726

Chapter 4

Chapter four is a quantitative evaluation of the tailored education program, reporting change in participant fall prevention behaviour within six-months after discharge home from hospital. Levels of engagement in fall prevention strategies were compared between intervention and control groups. This chapter is based on a published article.

- **Naseri, C**., McPhail, S. M., Haines, T. P., Morris, M. E., Etherton-Beer, C., Shorr, R., Flicker, L., Balsara, M., Netto, J., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A.-M. (2019). Evaluation of tailored falls education on older adults' behaviour following hospitalisation. *Journal of the American Geriatrics Society, 0* (00), 1-8. doi:10.1111/jgs.1605386ut86ut5t

Chapter 5

Chapter five reports the quantitative levels of capability and motivation of participants during the post-discharge period. These are behavioural components based on the COM-B model of health behaviour change (Michie, van Stralen, & West, 2011), and were compared between those who received the tailored education intervention, and control. This chapter is based on a manuscript that is under peer review.

- **Naseri, C**., McPhail, S.M., Morris, M.E., Haines, T.P., Etherton-Beer, C., Shorr, R., Flicker, L., Bulsara, M., Netto, J., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A-M. (2019). Older adult capability and motivation for falls prevention post-hospitalisation: evaluation of tailored education. (under peer review).

Chapter 6

Chapter six reports the qualitative exploration of participants' barriers and enablers that affected their engagement in fall prevention activities within six months after discharge home from hospital. This chapter is based on a manuscript that is under peer review.

- **Naseri, C**., McPhail, S.M., Haines, T.P., Morris, M.E., Shorr, R., Etherton-Beer, C., Netto, J., Flicker, L., Bulsara, M., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A-M. (2019). Perspectives of older adults on barriers and enablers to engagement in fall prevention activities following hospital. (under peer review)

Chapter 7

Chapter seven synthesises the findings from this research and discusses these in relation to the research aims, and other relevant research. Concluding remarks for this thesis and detailed recommendations for future research and clinical practice are presented.

1.4 References

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CHAPTER 2 Reducing falls in older adults recently discharged from hospital: A systematic review and meta-analysis

Preface

There is limited synthesised evidence for effective fall prevention interventions for older adults who have recently been discharged home from hospital. This chapter describes a systematic review and meta-analysis and is based on two published articles:

Naseri, C., McPhail, S., Francis-Coad, J., Haines, T., Etherton-Beer, C., Morris, M. E., Flicker, L., Shorr, R., Balsara, M., Netto, J., Lee, D-C.A., Waldron, N., Boudville, A., Hill, A.-M. (2017). Effectiveness of falls prevention interventions for older adults newly discharged from hospital: a systematic review protocol. *JBI Database of Systematic Reviews and Implementation Reports, 15*(3), 686-693. doi:10.11124/JBISRIR-2016-002952

Naseri, C., Haines, T. P., Etherton-Beer, C., McPhail, S., Morris, M. E., Flicker, L., Netto, J., Francis-Coad, J., Lee, D-C.A., Shorr, R., Hill, A.-M. (2018). Reducing falls in older adults recently discharged from hospital: a systematic review and meta-analysis. *Age and Ageing, 0*, 1-8. doi:10.1093/ageing/afy043

2.1 Abstract

Background

Older adults are known to have increased falls rates and functional decline following hospital discharge, with substantial economic health care costs. This systematic review aimed to synthesise the evidence for effective falls prevention interventions in older adults recently discharged from hospital.

Methods

Literature searches of six databases of quantitative studies conducted from 1990 to June 2017, reporting falls outcomes of falls prevention interventions for community-dwelling older adults discharged from hospital were included. Study quality was assessed using a standardized JBI critical appraisal tool (MAStARI) and data pooled using Rev-Man Review Manager®.

Results

Sixteen studies (total sample size N= 3290, from 8 countries, participants' mean age 77 (SD 7 years) comprising 12 interventions met inclusion criteria. We found home hazard modification interventions delivered to those with a previous falls history (1 study), was effective in reducing the number of falls (RR 0.63, 95%CI 0.43, 0.93, Low Grade evidence). Home exercise interventions (3 studies) significantly increased the proportion of fallers (OR 1.74, 95%CI 1.17, 2.60, Moderate Grade evidence), and did not significantly reduce falls rate (RR 1.27, 95%CI 0.99, 1.62, Very Low Grade evidence) or falls injury rate (RR 1.16, 95%CI, 0.83,1.63, Low Grade evidence). Nutritional supplementation for malnourished older adults (1 study) significantly reduced the proportion of fallers (HR 0.41, 95% CI 0.19, 0.86, Low Grade evidence).

Conclusion

The recommended falls prevention interventions for older adults recently discharged from hospital are to provide home hazard minimisation particularly if they have a recent previous falls history and consider nutritional supplementation if they are malnourished.

2.2 Introduction

Falls are known to increase among older adults during the post-discharge period with an increased risk of hip fracture (Hill et al., 2011; Wolinsky et al., 2009). While the average annual fall rate is 30% in the general older community with 10% of these falls resulting in a serious injury (Gillespie et al., 2009), more than 40% of older adults recently discharged from hospital fall at least once in the 6-month period following discharge and 54% of these falls result in a serious injury (Forster, Murff, Peterson, Gandhi, & Bates, 2003; Mahoney et al., 2000).

Several large systematic reviews have established evidence for the effectiveness of falls prevention interventions for older adults in the general community (Gillespie et al., 2012; Goodwin, Jones-Hughes, Thompson-Coon, Boddy, & Stein, 2011; Sherrington et al., 2017). However, the studies included in these reviews did not specifically evaluate interventions in the post-discharge period and the findings may not translate to falls prevention among community-dwelling older adults recently discharged from hospital. Systematic reviews of interventions that provided broad discharge support for older adults showed limited reduction in falls or adverse events (Conroy, Stevens, Parker, & Gladman, 2011; Mistiaen, Francke, & Poot, 2007). One systematic review that evaluated falls prevention education for older adults concluded there was some evidence that education was effective in reducing falls rates during and after hospitalisation (risk ratio [RR] 0.77, 95% confidence interval 0.69 to 0.87), however other falls prevention interventions were not examined (Lee, Pritchard, McDermott, & Haines, 2014). The lack of research evidence regarding effective falls prevention interventions in the period following hospitalisation needed to be addressed.

The primary objective of this review was to collate RCTs that delivered falls prevention interventions for older adults just prior or immediately following hospital discharge, and to synthesise the evidence regarding their effectiveness during the 6 months immediately following hospital discharge.

2.3 Methods

A review was undertaken according to a protocol published in JBI Register of Systematic Reviews and Implementation Reports (Naseri et al., 2017), and reported in accordance with PRISMA guidelines (Liberati et al., 2009).

2.3.1 Search strategy

The search was undertaken using a three-step strategy recommended by the JBI systematic review library, using MeSH terminology and keywords to ensure all relevant studies were captured. Full details of the search strategy using PubMed terminology can be found in Appendix D.

A three-step search strategy was conducted using MeSH terminology and keywords to ensure all relevant studies were captured. At stage one the first author conducted a search of MEDLINE (Ovid), PubMed and CINAHL Plus with full text (EBSCO) using key words accidental fall, fall, intervention; and prevent combined with post-hospital, after hospital, hospital discharge; and older and age. Text words in the title and abstract of the identified studies together with index terms describing these studies were used in five further databases: the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library), The JBI Database of Systematic Reviews and Implementation Reports, EMBASE, AMED and Psych INFO. Unpublished studies were sought by conducting an electronic search of trials registers Current Controlled Trials (http://www.controlled-trials.com) and the National Institute of Health Clinical Database (http://clinicaltrials.gov), Universal Index of Doctoral Dissertations in Progress, Mednar, Grey Literature Report and Google. Additionally, hand searches of reference lists of all identified studies were performed.

Stage two of study selection involved a full screening of the abstracts by the first author (CN), then in stage three eligibility assessment was performed by two reviewers using full text retrieval. A third reviewer was available for final consensus.

2.3.2 Inclusion Criteria

This review examined studies that evaluated any falls prevention intervention delivered to adults 60 years of age or older who were hospitalised and then discharged to the community. The interventions must have been delivered/commenced in hospital or in the first month after hospital discharge from hospital (Naseri et al., 2017). Studies eligible for the review were published and unpublished studies written in English from any country between January 1990 and June 2017, including RCTs and pseudo-RCTs comparing interventions against no intervention or placebo control. The start date of 1990 was considered appropriate as research concerning falls prevention is a relatively recent field and other large systematic reviews investigating falls interventions include RCTs dated from 1990 (Campbell et al., 1990). Studies needed to measure a falls outcome within at least 6 months after discharge from hospital including falls rate (expressed per 1000-person days), proportion of people who fell one or more times, injurious falls rate (expressed per 1000-person days) or proportion of people who had one or more injurious falls, with consideration of ProFANE common set of falls outcome definitions and measures (Lamb et al., 2011).

2.3.3 Study Quality

Papers selected for critical appraisal were assessed by three independent reviewers for risk of bias and methodological quality (Naseri et al., 2017). This was completed prior to inclusion in the review, using the standardised critical appraisal from JBI Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI), found in Appendix E.

2.3.4 Data Synthesis and Analysis

Data was collated by one reviewer then three reviewers independently confirmed accuracy of the data synthesis. Effectiveness of interventions were classified according to outcomes (Lamb et al, 2005). For outcomes reported as rates (rates of falls and rate of injurious falls), data were pooled using inverse variance DerSimonian and Laird method (DerSimonian, 1986). This produced a relative rate effect size with 95% confidence intervals (CI). For outcomes measured as proportions, the number of fallers and non-fallers in each group were entered and data pooled using Mantel-Haenszel model (Higgins, 2011). This produced an odds ratio (OR) with 95% confidence intervals. For studies that employed factorial designs, we extracted the main effect of each intervention if no interaction effect was identified. Quantitative data were pooled in statistical meta-analysis using Rev-Man Review Manager (Version 5.3.2014 TM) to generate forest plots. All studies were analysed in terms of falls outcomes and sub-group meta-analyses based on pooling of comparable interventions. Heterogeneity was assessed using the I^2 statistic and visual inspection of forest plots. A fixed-effects model was used to calculate estimates, based on examination of the literature (Higgins, Thompson, Deeks, & Altman, 2003; Tufanaru, Munn, Stephenson, & Aromataris, 2015). The criteria that guided our decision to use the fixed-effect model in meta-analysis was the small number, size and heterogeneity of the studies evaluating each falls intervention. The included studies were clinical trials, methodologically homogenous, and measured one common true effect, a falls outcome. The only possible exception within this criterion was potential between-study heterogeneity of the participants. Notwithstanding fulfilment of our study sample inclusion criteria, we reasonably considered the participants to be similar enough to appropriately represent the population of older people recently discharged from hospital.

2.4 Results

2.4.1 Selected Studies

The search generated 1068 articles from the six databases. Figure 1 illustrates the study selection process. Table 2.1 outlines the characteristics of included (n=16) studies. The articles included in the review comprised one quasi RCT and 15 RCTs. The selected studies sample populations consisted of older adults recruited from inpatient wards. The mean age of participants in the 16 studies were 77 years, ranged between 70 and 84 years.

2.4.2 Study Population

The articles included in the review comprised 15 RCTs and one quasi RCT (Di Monaco et al., 2008). Eight of the studies were conducted in Australia (Batchelor, Hill, Mackintosh, Said, & Whitehead, 2012; Cumming et al., 1999; Haines et al., 2009; Hill, Etherton-Beer, et al., 2013; Hill et al., 2011; Latham et al., 2003; Sherrington et al., 2014; Treacy et al., 2015), two in Germany (Hauer et al., 2001; Nikolaus & Bach, 2003), and Italy (Di Monaco et al., 2015; Di Monaco et al., 2008), one in Switzerland (Bischoff-Ferrari et al., 2010), Taiwan (Huang & Liang, 2005), Netherlands (Neelemaat et al., 2012), and Sweden (Berggren et al., 2008).

The sample sizes ranged from 50 (Hill et al., 2013) to 530 (Cumming et al., 1999), with a total sample size of 3290. The mean age across the 16 studies was 77 years, with an age range of 70-84. The total number of participants that completed baseline assessment was 3,290 and 2,729 completed final assessments across the 16 studies, with an average retention rate of 83%.

The largest drop-out rate was 30% (Neelemaat et al., 2012), with 70% of participants retained over a three-month study duration, however this drop-out rate could be explained by the frailty of the population (participants were malnourished). The lowest drop-out rate was 7.4% in a study of one year's duration (Sherrington et al., 2014).

Table 2.1 Characteristics of studies included in the Systematic Review

Study *	Population†	Therapy, Dose, Frequency	N (I, C)	Mean age, Female% Drop-out%	F/Up, months setting	How falls assessed	Incident Rate Ratio Total Falls (95% CI)	Incident Rate Ratio of Falls Injuries (95% CI)	Risk Ratio of Fallers (95% CI)
Batchelor et al. Australia	Recent stroke and assessed high falls risk	**I: 1.** PT HEP (Otago), 30-40min, 3-5x/week **2.** Falls advice based on FROP-Com **C:** UC	156 (64, 80)	70, 36.5%, 15%	12 HV	Monthly FD mailed	1.10(0.63,1.90)	1.57 (0.73, 3.4)	0.83(0.60,1.14)
Berggren et al Sweden	Post-repair hip fracture	**I:** GMT in hospital then AH P/C 2weeks post-d/c offered rehabilitation in home or DH **C:** UC	199 (102, 97)	82, 74%, 20%	12‡HV	MR in hospital & during F/Up HV	12months 0.64(0.40, 1.02)	n/a	n/a
Bischoff-Ferrari et al. **§** Switzerland	Post-repair hip fracture	**I:** PT HEP **C:** no HEP	173 (87, 86)	84, 79.2%, 26%	6 & 12 HV	Monthly PC & FD	0.75 (0.56,0.99)	n/a	n/a
Bischoff-Ferrari et al. **§** Switzerland	Post-repair hip fracture	**I:** Vit D 2000IU/day for 12 months **C**: Vit D 800IU/day for 12 months	173 (86, 87)	84,79.2%, 26%	6 & 12 HV	Monthly PC & FD	1.28 (0.96, 1.68)	n/a	n/a
Cumming et al. Australia	Post-rehabilitation	**I:** OT HV & HHM recommendations monitored at 2 weeks **C:** UC	530 (264, 266)	77, 57%, 27%	12 HV or PC	Monthly FD mailed	n/a	n/a	1.27 (0.9, 1.8)
Di Monaco et al ∗ Italy	Recent hip fracture	**I:** Single HV by OT suggestions for HHM **C:** UC	95 (58, 61)	80, 100%, 7%	6 HV	6-month HV VR	n/a	n/a	OR 0.275 (0.08, 0.94)
Di Monaco et al. Italy	Recent hip fracture	**I:** Single OT PC to recommend HHM **C**: UC	169 (78, 75)	78, 100%, 9.5%	6 PC	6-month PC VR	n/a	n/a	1.06 (0.48, 2.34)

Haines et al. Australia	Post-d/c geriatric, surgical or medical	**I:** HEP using Kitchen table +DVD +workbook delivered by PT in home monitored weekly for 8weeks (P/C or HV) **C:** UC	53 (19, 34)	80, 60%, 5.7%	2 & 6 clinic or PC	Monthly PC & FD	0.72 (0.33,1. 57)	Fracture: 0.88 (0.08, 9.7)	0.96 (0.31, 3.00)
Hauer et al. Germany	Post d/c from falls-related rehabilitation	**I:** DH Ex 3days/week for 12 weeks **C:** Placebo ex group	57 (31, 26)	82, 100%, 21%	3 & 6 clinic	Fortnightly FD and VR in clinic	0.75 (0.45, 1.24)	n/a	n/a
Hill et al. Australia	Older inpatients	**I:** Tailored education focussed on post-discharge falls prevention **C**: UC	50 (25, 25)	78, 64%, 2%	1 PC	1 Month PC	0.29 (0.08, 1.05)	0.23 (0.03, 1.63)	0.33 (0.08, 1.33)
Hill et al. Australia	Older inpatients	**I:** Inpatient falls prevention education Materials only self-directed workbook and DVD. Complete: Materials + Health professional tailored education **C:** UC	343 (Mat 123, Complete 120, Control 100)	79.4, 61.2%, 11%	6 PC	Monthly PC & FD	Mat only 1.48(0.95, 2.30) Compl1.18(0.71 , 1.96)	Mat only 1.36 (0.80, 2.30) Compl1.0 0 (0.60, 1.66)	Mat only 2.12(1.21, 3.70) Compl1.34 (0.76, 2.37)

Huang & Liang Taiwan	Recent hip fracture	**I:** d/c plan + brochure + social supports+ HV at 1-week post-d/c by Nurse+ weekly PC 3 months **C:** UC (no brochures or HVs)	126 (63, 63)	75, 69%, 3%	2 & 12 weeks HV	Weekly PC & FD	n/a	n/a	n/a
Latham et al. **§** Australia & New Zealand	Frail older people	**I:** High intensity quadriceps resistance HEP using ankle weights 3 times per week for 10 weeks **C:** Frequency matched HV	243 (112, 110)	79, 53%, 5.6%	3 & 6 HV	FD & weekly PC	0.96 (0.67, 1.36)	n/a	n/a
Latham et al. **§** Australia & New Zealand	Frail older people	**I:** Single dose Vit D, 300,000IU **C:** placebo tablets	243 (108, 114)	79, 53%, 5.6%	3 & 6 HV	FD & weekly PC	1.12 (0.79, 1.59)	n/a	n/a
Neelmaat et al. Netherlands	Malnourished older people	**I:** Nutritional supplementation (energy + protein + 400IU VitD)/day + weekly phone counselling for 3 months **C:** UC	210 (105, 105)	74, 58%, 30%	6 & 12 weeks	FD 6 and 12 weeks	n/a	n/a	0.41 (0.19, 0.86)

Nikolaus & Bach Germany	Older inpatients	**I:** HIT HV + HHM recommended and monitored at 3 months **C:** Geriatric assessment	360 (181, 179)	81.5, 73.3%, 5%	3 & 12 HV	Monthly PC & FD	0.69 (0.51, 0.97)	n/a	n/a
Sherrington et al Australia	Older inpatients	PT prescribed HEP using Better Balance Program + workbook, unsupervised recommended 6 times per week for 20-30minutes.10 HV over 12 months to monitor **C:** UC+ falls prevention booklet	340 (171,169)	81.2, 74%, 7%	3 & 12 HV	Monthly FD	1.43 (1.07,1.93)	1.14 (0.76, 1.73)	1.38 (1.11, 1.73)
Treacy et al. Australia	Older rehabilitation patients	**I:** Inpatient balance circuit class 6 x 1-hour sessions over 2 weeks supervised by PT **C:** no class	162 (81, 81)	82, 52%, 14%	2 weeks and 3 months clinic	VR at 2 weeks and 3 months clinic	1.13 (0.64, 1.96)	n/a	n/a

Notes: ∗RCT except Di Monaco et al is a quasi RCT † Community-dwelling older adults recruited from hospital **I** Intervention **C** Control **PT** Physiotherapist **HEP** Home exercise program **FROP-Com** Falls risk assessment tool for older people in the community **UC** usual care **F/Up** Follow-up **FD** Falls diary **CI** Confidence interval **n/a** not available from the study **DH** Day hospital **GMT** Geriatric management team **AH** Allied Health ‡from day of hospital admission **d/c** discharge **MR** Medical records **HV** Home visit **§**Factorial designed RCT **VitD** Vitamin D **PC** Phone-call **OT** Occupational therapist **HHM** Home hazards modification **DH Ex** Day hospital strength and balance exercise program **VR** Verbal reports + plus **HIT** Home intervention team, consists of either a PT or OT and a Nurse

All the selected studies' sample populations consisted of older adults recruited from inpatient wards, 6 of the studies followed patients with a hip fracture (Berggren et al., 2008; Bischoff-Ferrari et al., 2010; Di Monaco et al., 2008; Di Monaco et al., 2015; Hauer et al., 2001), 9 followed patients from a rehabilitation ward (Berggren et al., 2008; Cumming et al., 1999; Di Monaco et al., 2008; Haines et al., 2009; Hill et al., 2011; Hill et al., 2013; Latham et al., 2003; Neelemaat et al., 2012; Nikolaus & Bach, 2003; Treacy et al., 2015), and 1 study followed patients who had a diagnosis of stroke from a stroke ward (Batchelor et al, 2012).

Twelve studies excluded older adults with cognitive impairment (Berggren et al., 2008; Cumming et al., 1999; Di Monaco et al., 2008; Di Monaco et al., 2015; Huang & Liang, 2005; Haines et al., 2009; Hauer et al., 2001; Hill et al., 2011; Hill et al., 2013; Latham et al., 2003; Nikolaus & Bach, 2003; Sherrington et al., 2014).

All studies' populations consisted of participants who were discharged home to the community and 4 studies also included 5-17% of participants who were discharged to a residential care setting (Hill et al., 2011; Latham et al., 2003; Neelemaat et al., 2012; Treacy et al., 2015). One study population consisted of 37% of participants discharged to a residential care setting (Berggren et al., 2008), and one study did not specify discharge destination in the inclusion criteria or baseline characteristics (Treacy et al., 2015).

There were a wide range of baseline characteristics measured across the studies (Table 2.1). Falls risk factors such as number of falls during 1 year prior to admission or inpatient falls, gait, mobility, and cognition were recorded in most included studies baseline characteristics. Three studies did not record number of inpatient falls prior to discharge (Bischoff-Ferrari et al., 2010; Di Monaco et al., 2015; Neelemaat et al., 2012). As an established clinical predictor of falls following hospital discharge (Hill, Hoffmann, & Haines, 2013), this would ideally have been required during selection and randomisation to avoid selection bias.

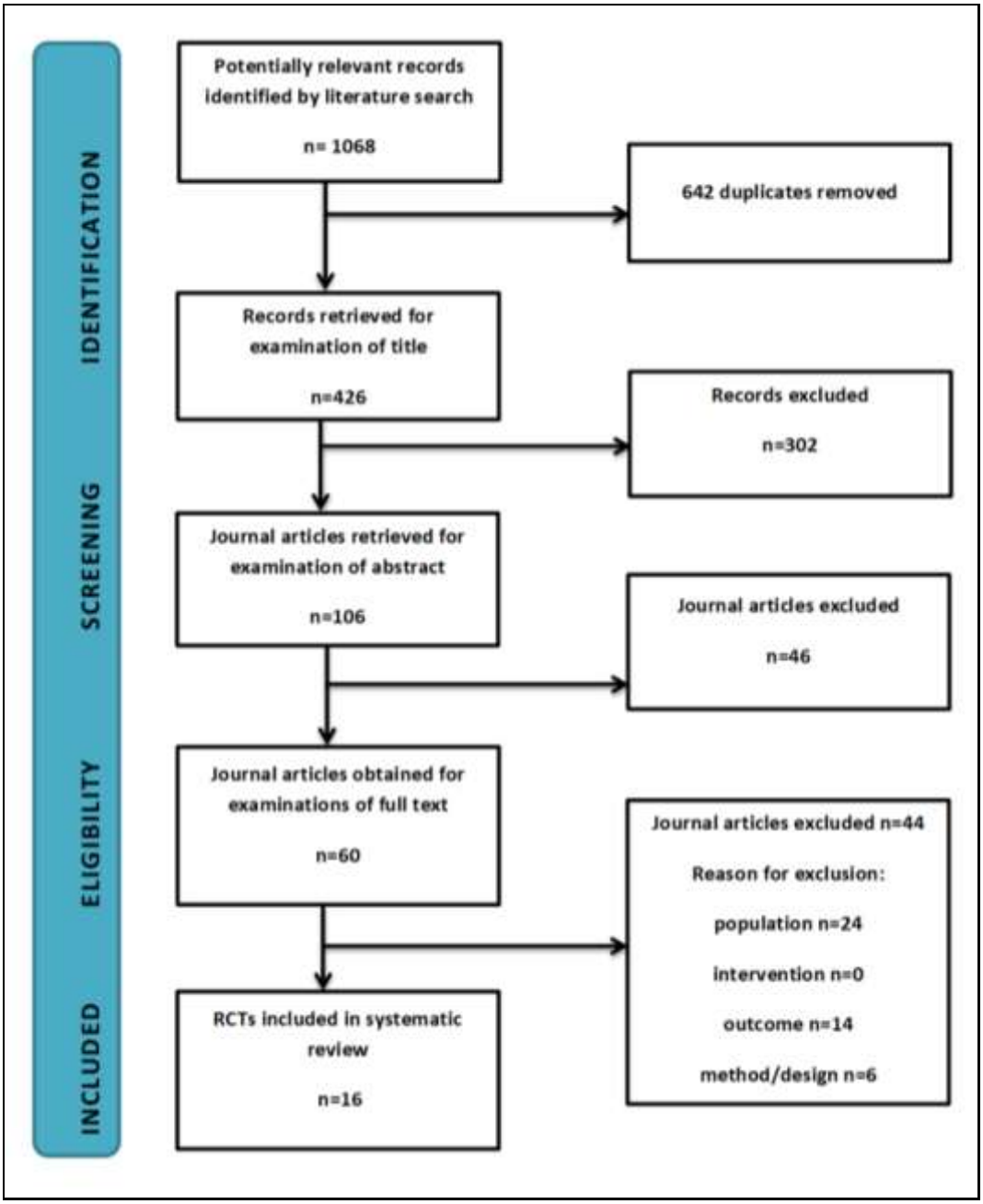

Figure 2.1 Flowchart showing selection of studies for inclusion in the review

2.4.3 Study Interventions

The interventions from 9 studies were grouped according to a recommended taxonomy to describe falls-prevention interventions (Lamb et al., 2011), including home hazard modification interventions, home exercise program, and cholecalciferol therapy. Two studies delivered exercise and cholecalciferol in factorial designed RCTs (Bischoff-Ferrari et al., 2010; Latham et al., 2003). One study provided a home exercise intervention as well as multifactorial falls risk minimisation strategies based on falls risk factors (Batchelor et al, 2012), identified using a falls risk assessment tool for older people in the community (FROP-Com) (Russell et al., 2009).

There were 8 interventions included in the review that could not be pooled in meta-analysis because they only featured once across all the studies. These were geriatric team management, inpatient falls prevention education, tailored falls prevention education prior to discharge, a day hospital balance class, high intensity quadriceps exercise, nutritional supplementation, discharge planning, and an inpatient balance circuit class.

2.4.4 Quality of Studies

The critical appraisal of 16 included studies can be found in Table 2.2. There were 14 studies that satisfied concealed random allocation of participants to intervention and control groups, two studies being unclear in their description of randomisation, sequencing, allocation and concealment (Di Monaco et al., 2008; Hauer et al., 2001). Only 2 studies were compliant in blinding of participants (Haines et al., 2009; Hill et al., 2013), while all studies consistently showed an intention to treat and included loss to follow-up data in the analysis. Three studies did not maintain blinding of outcome assessors (Berggren et al., 2008; Di Monaco et al., 2008; Huang & Liang, 2005), introducing the potential for selective outcome reporting bias (Porritt, Gomersall, & Lockwood, 2014). The remaining studies followed international recommendations of reporting falls outcomes, with daily prospective falls reporting using a falls diary coupled with details about falls through a phone call at least once per month (Haines & Hill, 2011).

2.4.4.1 Excluded Studies following critical appraisal

The trial led by Huang and Liang, (2005) provided a discharge plan for older adults in Taiwan returning home from hospital following a fall related hip fracture. Secondary falls outcomes measured were limited to the proportion (number) of fallers, while incidence of falls or injurious falls were not reported. The study did not limit potential risk of bias when some participants moved between families to enable sharing of carer responsibility, and this was a noted limitation as it may have affected data collection and blinding of outcome assessors. Due to these disparities in quality, the study was subsequently removed from the meta-analysis.

The study led by DiMonaco (2008) was the only quasi RCT included in the review. This study evaluated occupational therapy home visits for falls prevention by obtaining falls data verbally and retrospectively from participants at the 6-month follow-up home visit. The JBI critical appraisal tool for quasi-experimental studies accommodates an absence of random allocation, however there is still a requirement for outcomes to be measured in a reliable way, and at multiple time points after the intervention is complete. As this study did not measure falls in accordance with recommended guidelines and obtained follow-up data on only one occasion at 6 months post-discharge, it had reduced power to reliably detect falls incidence (Cummings, Nevitt, & Kidd, 1988), hence the study was removed from the meta-analysis.

Table 2.2 Critical appraisal of all studies in Systematic review and Meta-analysis

Study	Sequence generation	Participant blinding	Allocation concealment	All data addressed	Assessor blinding	Similar baseline characteristics	Groups treated identically except for intervention	Outcome measures same for groups	Outcomes measured reliably	Appropriate statistical analysis used
Batchelor et al, 2012	Y	N	Y	Y	Y	Y	N	Y	Y	Y
Berggren et al, 2008	Y	U	Y	Y	N	Y	Y	Y	Y	Y
Bischoff-Ferrari et al, 2010	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Cumming et al, 1999	Y	U	Y	Y	Y	Y	Y	Y	Y	Y
Di Monaco et al, 2008	U	N	N	Y	N	Y	Y	Y	N	Y
Di Monaco et al, 2015	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Haines et al, 2009	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Hauer et al, 2001	U	N	U	Y	Y	Y	Y	Y	Y	Y
Hill et al, 2011	Y	N	Y	Y	Y	Y	Y	Y	Y	Y

Hill et al, 2013	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Huang & Liang,2005	Y	N	Y	Y	N	Y	N	Y	U	U
Latham et al, 2003	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Neelmaat et al, 2012	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Nikolaus & Bach, 2003	Y	U	Y	Y	Y	Y	Y	Y	Y	Y
Sherrington et al, 2014	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Treacy et al, 2015	Y	N	Y	Y	Y	Y	U	Y	Y	Y

Note. Y=Yes, N=No, U=Unclear

2.4.5 Effectiveness of fall prevention interventions

2.4.5.1 Home hazard modification

Three trials evaluated the effect of home hazard modification interventions on falls outcomes, however they differed in their presentation of effect estimates, therefore their results were analysed at the individual study level. One study dichotomised fall data, showing no significant effect on proportion of fallers (relative risk 1.06, 95%CI, 0.48, 2.34) (Di Monaco et al., 2015). Another study used the Andersen-Gill approach (Hazard ratio [HR]) to describe falls as recurrent events and showed a significant reduction in proportion of fallers for the subgroup of participants with a previous falls history as illustrated in Figure 2.2 (HR 0.75, 95%CI 0.58, 0.96) (Cumming et al., 1999).

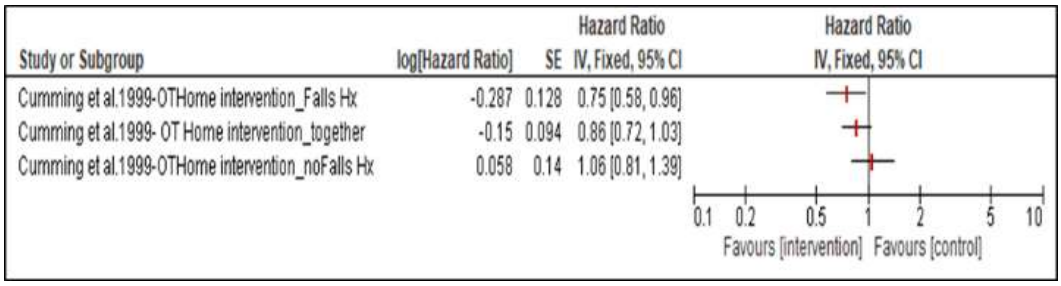

Figure 2.2 Un-pooled effect estimates of intervention delivered by Cumming et al., 1999

Note OT Home intervention_FallsHx Outcome for participants who had a history of falls **OT Home intervention_together** Outcome for participants who had a history of falls and no history of falls together **OT Home intervention_no Falls Hx** Outcome for participants who had no falls history

In another study that delivered home hazard modification, results showed a reduction in falls using rate ratio (RR), also for the subgroup of participants with a previous history of frequent falls (RR 0.63, 95%CI 0.43, 0.93) (Figure 2.3) (Nikolaus & Bach, 2003).

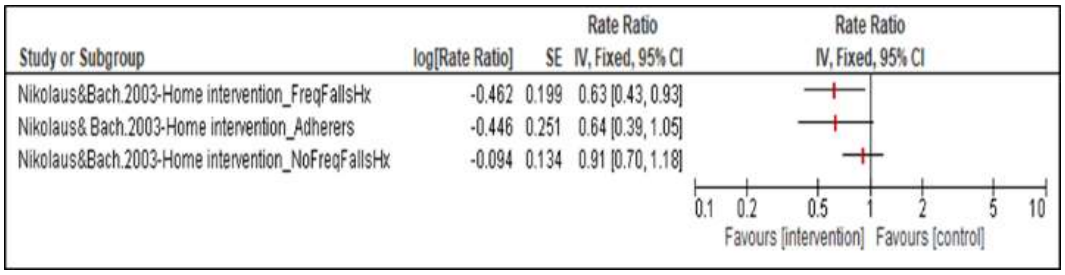

Figure 2.3 Un-pooled effect estimates of intervention delivered by Nikolaus et al, 2003

Note Home intervention_FreqFallsHx Outcome for those participants with a frequent fall history **Home intervention_Adherers** Outcome for those participants who adhered to the intervention **Home intervention_No FreqFallsHx** Outcome for those participants who did not have a frequent falls history

2.4.5.2 Short-term nutritional supplementation

A single study provided a multi-component nutritional intervention that included cholecalciferol supplementation for malnourished older adults commencing at hospital admission and continuing to 3 months after discharge (Neelemaat et al., 2012). Falls rates were treated as binary data (participants did/did not fall), describing the hazard ratio of patients experiencing one or more falls, with an overall significant reduction in the number of people who fell (HR 0.41, 95% CI, 0.19,0.86) at the study level.

2.4.5.3 Home exercise

Meta-analysis of falls rate data from 3 studies (Batchelor et al, 2012; Haines et al., 2009; Sherrington et al., 2014) in the home exercise group of interventions showed moderate heterogeneity (I^2=32% p=0.23), this may have been due to the differing doses of intervention and clinical variation in the populations across the studies. Overall the intervention did not significantly reduce falls (RR 1.27, 95%CI 0.99, 1.62), or falls injuries (RR 1.16, 95%CI, 0.83,1.63), however meta-analysis from 2 studies found a significant increase in proportion of fallers (OR 1.74, 95%CI, 1.17, 2.60) (Figure.2.4).

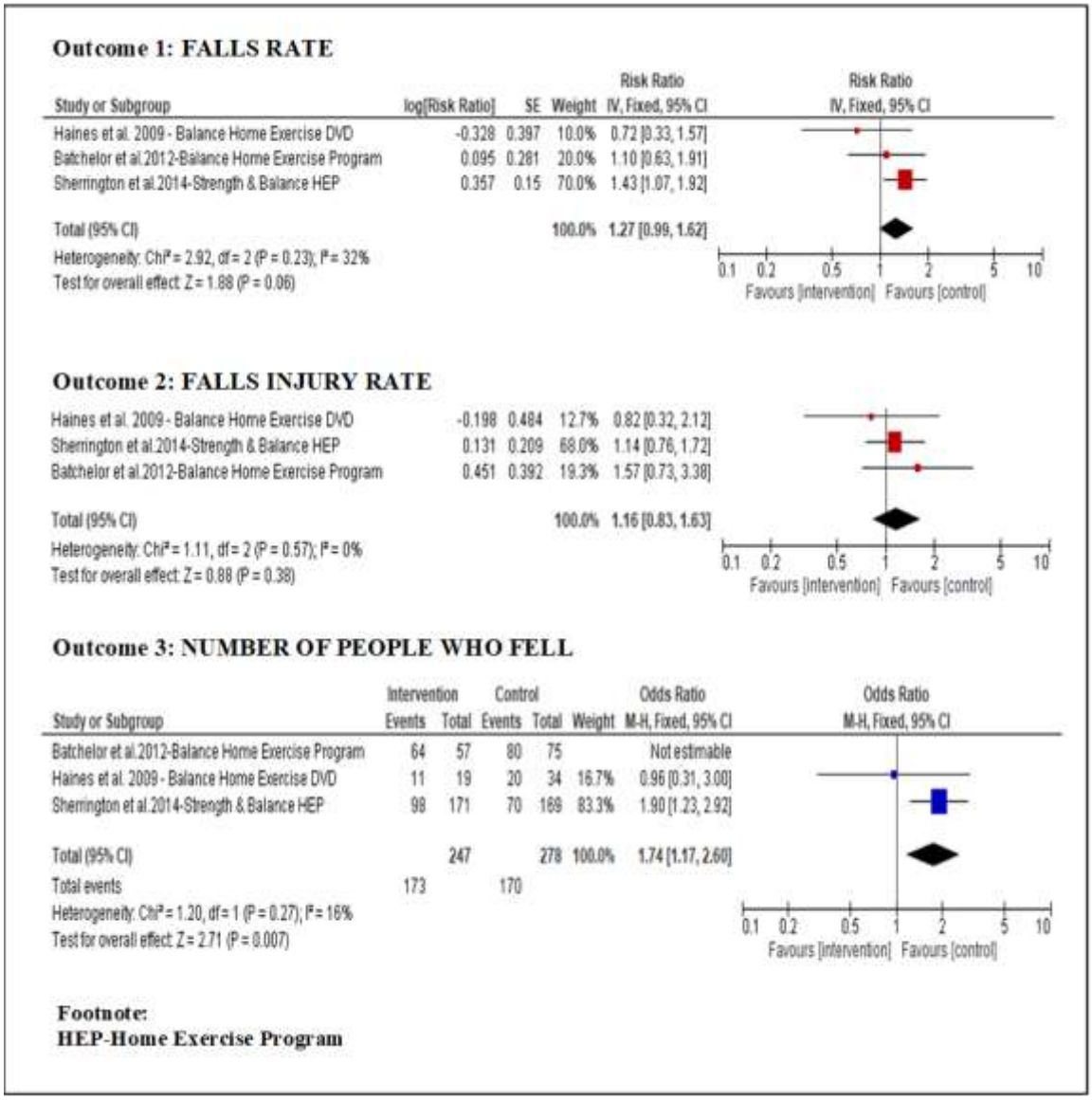

Figure 2.4 Pooled effect estimates of home exercise interventions on fall outcomes

2.4.5.4 Cholecalciferol therapy

Two studies were included in analysis of cholecalciferol therapy, one described an increase in rate of falls (per observed patient year) using crude relative rate difference (30, 95% CI -1, 70), the other study described a non-significant effect using raw falls data (number of falls and fallers) and relative risk of a fall (0.96, 95%CI, 0.67, 1.36) though it was unclear if this was formulated based on (study or participant standardized) time or number of participants. The studies differed in falls outcome reporting, dose and duration of cholecalciferol therapy, one provided a daily high-dose (2000 IU) over one year, whereas the other a single dose (300,000IU), thus results of these studies were not pooled.

2.4.5.5 Falls prevention education

There were two studies in the review that provided falls prevention education, however the results were not pooled due to differences in the content and intended population of the intervention. One provided inpatient falls prevention education, whereas the other delivered education focused on falls prevention in the period after discharge. The education that focused on inpatient falls prevention had no ongoing effect in the 6 months after discharge. The study that delivered falls prevention education just prior to hospital discharge was effective in reducing falls rates (RR 0.3, 95% CI, 0.08,1.05), however had no significant effect on falls injury rates, or number of fallers (Figure 2.5 & 2.6).

2.4.5.6 Geriatric team management

One study provided geriatric team management, however, falls rates were not significantly reduced at the study level, expressed as incident rate ratio (IRR 0.64, 95%CI, 0.40, 1.02) (Figure 2.5).

2.4.5.7 Inpatient balance circuit training

One study investigated the efficacy of balance circuit training for inpatients over a 2-week period. Falls rates were reduced in hospital, however this did not carry over to the period following hospital discharge (IRR 1.13, 95% CI, 0.65, 1.98) (Figure 2.5).

2.4.5.8 High-intensity quadriceps resistance training

One study implemented a high-intensity quadriceps resistance exercise program in the home for older, frail people following hospital discharge, having no significant overall effect on falls rates after 6 months (RR 0.96, 95% CI, 0.67, 1.36) (Figure 2.5).

2.4.5.9 Day hospital strength and balance training

A single study provided strength and balance training in a day hospital setting for 3 days per week for 12 weeks for older women post hip fracture. Participants in the intervention group demonstrated improvements in strength and function, but no significant falls rate reduction during the 6-month post-discharge period (IRR 0.75, 95% CI, 0.46, 1.25) (Figure 2.5).

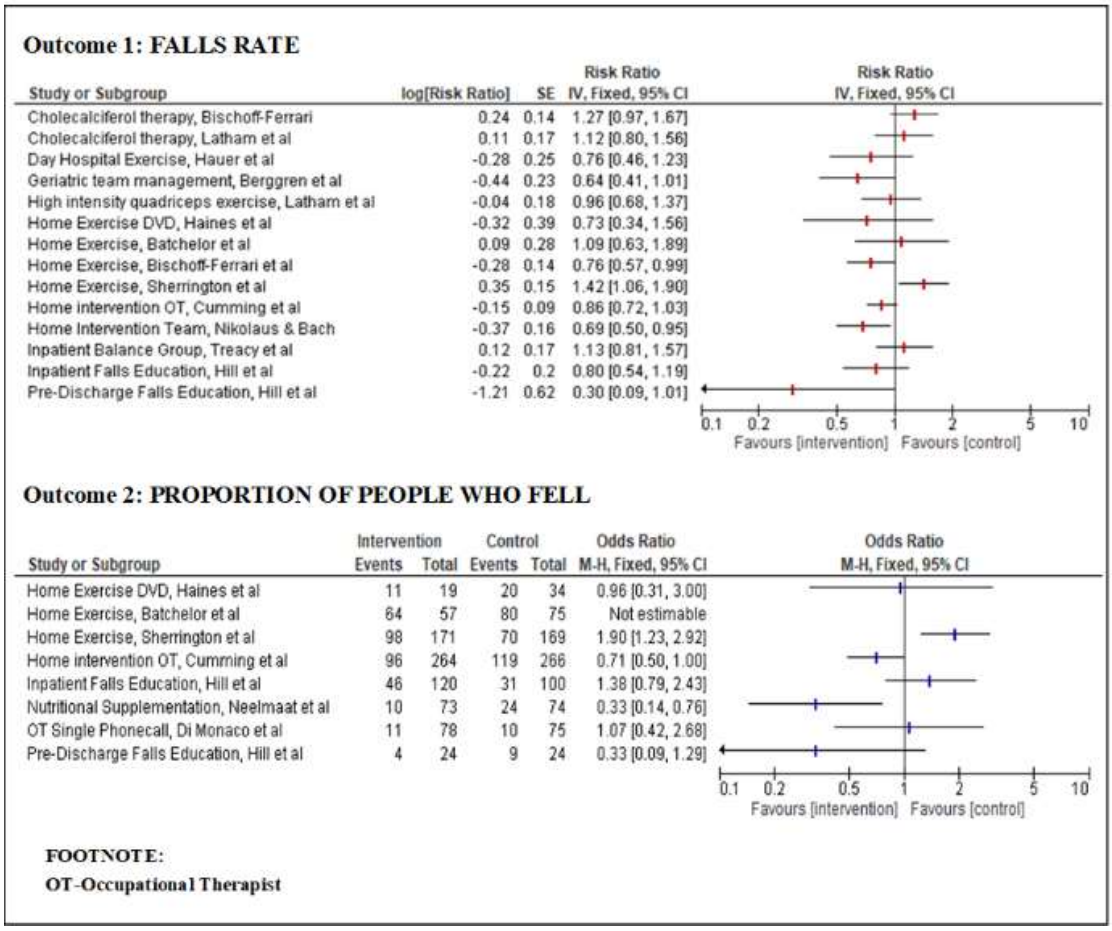

Figure 2.5 Un-pooled effect estimates of interventions on fall rate and proportion of fallers

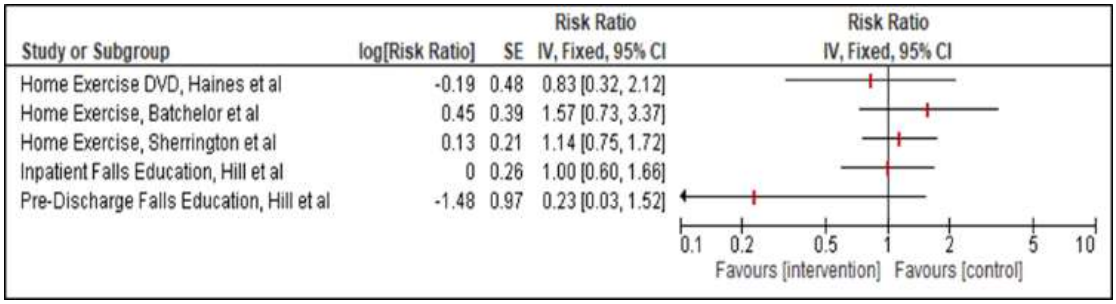

Figure 2.6 Un-pooled effect estimates of interventions on rate of fall injuries

2.4.6 Recommendations based on the evidence

All studies were analysed in terms of falls outcomes, and subgroup meta-analysis was based on pooling of comparable interventions, consistency of outcome measures, and heterogeneity. Figure 2.7 provides a summary of the evidence using the GRADE approach (Guyatt et al., 2008), including 4 studies that were grouped according to interventions.

	Number of Participants (studies)	**Quality of the evidence** (GRADE)	**ANTICIPATED ABSOLUTE EFFECTS**	
			Relative effects (%)	**Absolute effect with intervention** [95% CI]
HOME EXERCISE INTERVENTION				
Bibliography: Batchelor et al, (2012); Sherrington et al (2014); Haines et al (2009).				
Incident rate of falls Pooled	n= 525 participants (3 studies)	⨁⨀⨀⨀**VERY LOW**[1,2] due to inconsistency & imprecision	-	Risk ratio for falls in the intervention groups was **1.27** [0.99 to 1.62]
Incident rate ratio of falls injury rate Pooled	n= 525 (3 studies)	⨁⨁⨀⨀**LOW**[1] due to imprecision	-	Risk ratio for falls injuries in the intervention groups was **1.16** [0.83 to 1.63]
Proportion of fallers Pooled	n= 369 (2 studies)	⨁⨁⨁⨀ **MODERATE**	-	Odds ratio for proportion of fallers with intervention was **1.74** [1.17, 2.60]
NUTRITIONAL SUPPLEMENTATION				
Bibliography: Neelmaat et al (2012)				
Proportion of fallers	n= 210 (1 study)	⨁⨁⨀⨀**LOW** due to only 1 study	-	Hazard ratio for proportion of fallers with intervention was **0.41** [0.19, 0.86]

1 Imprecision: the 95% CI of the pooled estimate included 1 or no effect
2 Inconsistency: heterogeneity may be explained by the differing characteristics of the populations, content and duration of the intervention across the studies.
GRADE Working Group Grades of evidence **High quality:** Further research is very unlikely to change our confidence in the estimate of effect. **Moderate quality:** Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate. **Low quality:** Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate. **Very low quality:** We are very uncertain about the estimate.
The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
GRADEpro GDT: GRADEpro Guideline Development Tool [Software]. McMaster University, 2015 (developed by Evidence Prime, Inc.). http://www.Gradepro.org.

Figure 2.7 Grade Summary of the evidence

2.5 Discussion

2.5.1 Summary of findings

The present systematic review and meta-analysis was the first to synthesise evidence of effective falls prevention interventions for older adults following recent hospital discharge. Overall results indicated there was limited evidence that home hazard modifications reduced falls outcomes, though the intervention was more effective among a subgroup of participants who had a frequent falls history. Home hazard modifications have previously been found to be effective in preventing falls among the general community population (Gillespie et al., 2012), and are frequently a component of hospital discharge plans (Shepperd et al., 2013). These previous findings suggest that if these interventions were tailored and evaluated specifically for older adults recently discharged from hospital, there could be a greater amount of evidence of their effectiveness for falls prevention during the post-discharge period.

Previous evidence has shown that falls prevention exercise programs are beneficial for older adults in the community setting (Gillespie et al., 2012; Sherrington et al., 2017), however the findings of this review indicate they may have a different effect in older adults recently discharged from hospital. There are many precipitating factors to be considered in providing home exercise falls interventions to older adults following hospital discharge, including the likely need for regular supervision over an extended period to increase safety, challenge balance, and maintain compliance (Sherrington et al., 2017). A large meta-analysis led by Sherrington et al (2017) concluded that falls prevention programs that include a moderate to high challenge to balance are associated with a reduction in falls among community-dwelling older adults. However, when these exercise parameters were introduced to older adults recently discharged from hospital (Sherrington et al., 2014), this led to an increase in the number of falls, falls injuries, and proportion of fallers. The components of the home exercise program that may assist to explain this effect include no direct supervision or limited one-on-

one supervision of the exercises, and recommended frequencies of 30-40 minutes at least 3-6 days per week. Since this population is generally functionally declined, participants may have required more supervision initially, and a lower commencement dosage of exercise.

This review found that cholecalciferol therapy did not significantly reduce falls in older adults discharged from hospital. Although previous reviews have demonstrated a protective effect of cholecalciferol therapy on falls in community-dwelling and institutionalised older adults (Gillespie et al., 2012), some more recent RCTs have concluded a higher risk of falls at higher doses, particularly for older adults with a previous falls history (Bruyere et al., 2014; Glendenning et al., 2012). Despite the lack of evidence for falls prevention following hospital discharge, falls prevention guidelines recommend at least 800 international units of vitamin D per day for those with proven or suspected vitamin D deficiency, abnormal gait and risk of falls (Panel on Prevention of Falls in Older Persons, 2011).

Previous reviews have indicated that patient population may impact outcomes of falls prevention interventions, such as older adults who are frail and at risk of functional decline following recent hospital discharge (Conroy et al., 2011; Goodwin et al., 2014; Winter, Watt, & Peel, 2013). Critical elements of frailty, such as muscle weakness and malnutrition are associated with falls and functional decline (Gill, 1999). A multifactorial intervention incorporating an individualised home program for frail older adults improved risk factors for falls but did not reduce rate of falls (Fairhall et al., 2014). One study in this review that provided nutrition supplementation for malnourished older adults was effective in reducing the proportion of people who fell post-discharge (Neelemaat et al., 2012), indicating interventions that target elements of frailty are likely to have a positive effect on falls risk factors and falls outcomes. This result is consistent with previous RCTs and systematic reviews (Beswick et al., 2008; Chang et al., 2004; Mistiaen et al., 2007).

2.5.2 Study strengths and limitations

This systematic review was a comprehensive undertaking with a large range of falls prevention interventions analysed. Falls prevention interventions that are effective in the general older population may require tailoring to be effective for older adults recently discharged from hospital. There are additional and possibly specific factors to be considered in delivering interventions to this population, including the need for regular supervision and support to aid functional recovery and prevention of hospital re-admission.

Although this review did not find one falls prevention intervention was significantly effective overall, there is a possibility that tailoring different components of the interventions to the identified falls risks, physical and social needs of the older person, could lead to better uptake of falls prevention strategies. Although a large systematic review investigating falls prevention found multi-factorial interventions were implemented in 19 trials (Gillespie et al., 2012), we found no trials that evaluated multi-factorial falls interventions in the post-discharge setting. Targeted multi-dimensional falls risk assessment and management offered by multi-disciplinary specialists for older adults following hospital discharge is warranted. Especially considering current healthcare services tend to discharge older adults from hospital with ongoing medical illnesses, frailty and risk of further falls. This is a consideration for future research as multi-factorial falls interventions have been shown to be effective for falls prevention of older adults in the community setting (Gillespie et al., 2012).

A possible limitation of this review was the grouping of interventions that necessitated simplification of often complex interventions. The analysis was based on overall effects of the intervention categories, without consideration of characteristics of individual participants, modification of intervention doses, or adherence to interventions. The Grade summary of evidence table included four studies only as we found high heterogeneity and inconsistency across the remaining studies.

Despite efforts to be comprehensive in our choice of search terms, we did not cover all MeSH terms such as “elderly” and “seniors”, and so there was potential that studies were not found during our search strategy and screening process. However, the MeSH terms used in our search included “frail elderly” as well as people “aged 65 to 79 years”, and during the final search phase, we hand-searched reference lists of all studies examined in full text to strengthen our search.

2.5.3 Conclusion

Falls are a serious problem for older adults who have recently been discharged from hospital with associated decline in quality of life and functional independence (Covinsky, Pierluissi, & Johnston, 2011; Inouye, Studenski, Tinetti, & Kuchel, 2007). Falls prevention interventions found to be effective in the general older population are not necessarily transferrable to older adults following hospital discharge.

We found low to moderate quality Grade evidence following data-analysis from studies grouped according to interventions. The recommended fall prevention interventions for older adults recently discharged from hospital are to provide home hazard minimisation particularly if they have a recent previous falls history, and consider nutritional supplementation if they are malnourished. Future trials to investigate the post-discharge fall prevention effects of interventions delivered over an extended period after discharge, with supervision and structured progression of strategies such as exercise are warranted.

2.6 Summary and Gaps in the Research

The high methodological quality of the studies included in this review enabled effective intervention components to be considered for future research. The best available evidence indicates that multi-factorial fall prevention interventions that are tailored to individual fall risks, knowledge, and preferences could help to increase levels of engagement in fall prevention strategies, and intervention effectiveness. As the potential positive effects involve health behaviour change within the unpredictable context of older patients' life-situation after hospital discharge, translational research with longer follow-up periods is required to measure outcomes and identify barriers and enablers to behaviour change.

The present research in this thesis was focused on evaluating a tailored fall prevention education program that aimed at the point of hospital discharge to prospectively change health behaviour after patients returned home from hospital. Principally, this evaluation used the underlying theoretical framework of the tailored education intervention to understand the contextual factors of the population, and to understand the effectiveness of the intervention in modifying behaviour after hospital discharge.

2.6.1 Research Aims

Therefore, the primary aim of this thesis was to evaluate the impact of tailored fall prevention education provided at hospital discharge in addition to usual care, on older adults' engagement in falls prevention strategies within six months after hospital discharge, compared to control conditions.

2.6.1.1. Study 1 Aim (Chapter 4)

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 six-months after hospital discharge, compared to those who received a social intervention in addition to usual care.

2.6.1.2 Study 2 Aim (Chapter 5)

This study measured the level of capability and motivation for engagement in fall prevention strategies at six months after hospital discharge for participants who received the tailored education intervention in addition to usual care, compared to control conditions.

2.6.1.3 Study 3 Aim (Chapter 6)

The purpose of the study was to qualitatively explore perspectives of older adults regarding the barriers and enablers to engagement in fall prevention activities within six months after hospital discharge.

2.6.2 Overview of the Research Structure

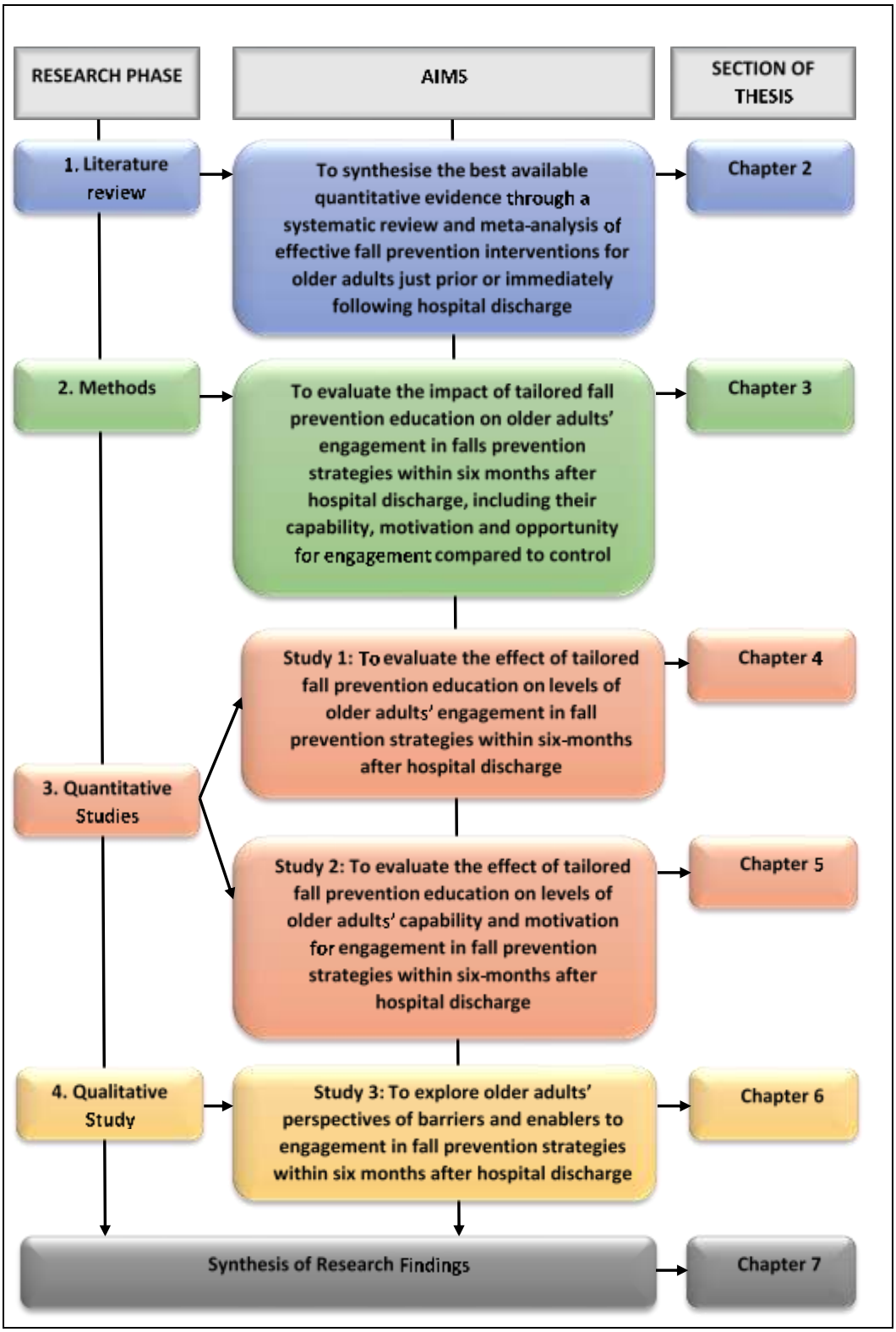

Figure 2.8 Overview of the Research Structure

2.7 References

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CHAPTER 3 Impact of Tailored Fall Prevention Education for Older Adults at Hospital Discharge on Engagement in Fall Prevention Strategies Post-Discharge: Protocol for a Process Evaluation

Preface

This chapter describes the methodological design of the research conducted as part of this thesis. To provide a more holistic understanding of the factors that mediate the effectiveness of the tailored education intervention, this prospective convergent embedded mixed method design used triangulation to describe the effects on fall prevention engagement. The chapter is based on a published article (see Appendix C).

Naseri, C., McPhail, S.M., Netto, J., Haines, T.P., Morris, M. E., Etherton-Beer, C., Flicker, L., Lee, D-C.A., Francis-Coad, J., Hill, A.M. (2018). Impact of tailored falls prevention education for older adults at hospital discharge on engagement in falls prevention strategies post-discharge: protocol for a process evaluation. *BMJ Open, 8*(4), e020726. doi:10.1136/bmjopen-2017-020726

3.1 Abstract

Background: Providing education to hospitalised patients on how to prevent falls at home could reduce post-discharge falls. There has been limited research investigating how older adults respond to tailored falls prevention education provided at hospital discharge. The aim of this research was to evaluate how providing tailored falls prevention education to older patients at the point of, and immediately after hospital discharge in addition to usual care, affects engagement in falls prevention strategies in the six months' post-discharge period, including their capability and motivation and opportunity to engage in falls prevention strategies.

Methods and analyses: This prospective observational cohort study was a process evaluation of an RCT using an embedded mixed-method design. There were two phases of quantitative evaluation that were then triangulated with findings of a qualitative evaluation. Participants (n=390) enrolled in the trial were over the age of 60, scoring greater than 7/10 on the Abbreviated Mental Test Score. Participants were being discharged from hospital rehabilitation wards in Perth, Western Australia, and followed up for six months post-discharge. Primary outcome measures for the process evaluation were engagement in falls prevention strategies, including exercise, home modifications and receiving assistance with activities of daily living. Secondary outcomes would measure capability, motivation and opportunity to engage in falls prevention strategies, based on the constructs of the COM-B behaviour system. Quantitative data would be collected at baseline, then at six months post-discharge using structured phone interviews. Qualitative data would be collected from a purposive sample of the cohort, using a semi-structured in-depth phone interview. Quantitative data would be analysed using regression modelling and qualitative data analysed using interpretative phenomenological analysis.

Conclusion: This process evaluation would assess older adults' response to the tailored education and explore barriers and enablers to fall prevention behaviour during the period following discharge home from hospital. Results would guide the effective provision of fall prevention education for older adults at point of hospital discharge.

3.2 Introduction

There is evidence for the effectiveness of exercise and physical activity (Morris et al., 2015; Sherrington, Tiedemann, Fairhall, Close, & Lord, 2011), along with home safety modifications; and vitamin d supplementation (Cumming et al., 1999; Gillespie et al., 2012), in reducing falls among older community dwelling adults including those with comorbidities. However, a systematic review of the literature (Chapter 2) found that falls prevention interventions previously found to be effective in the general older population, were not necessarily transferrable to older adults recently discharged from hospital (Naseri et al, 2018).

Older adults have been found to have reduced awareness of their falls risks and the benefits of fall prevention strategies, despite their increased falls risk during the post-discharge period (Haines, Day, Hill, Clemson, & Finch, 2014; Mihaljcic, Haines, Ponsford, & Stolwyk, 2017). A recent study showed that older people understood and effectively engaged in their discharge plan, yet experienced unanticipated problems, such as difficulty taking medications, uncontrolled pain, poor dietary intake and fragmented social supports (Greysen et al., 2016). Evidence shows tailored education increases older adults' engagement in falls prevention strategies after discharge (Hill, Etherton-Beer, & Haines, 2013), and is a component of effective falls prevention programs (Lee, Pritchard, McDermott, & Haines, 2014). However, there has been no RCT evidence to show that using patient education alone can reduce falls after discharge.

The first trial undertaken by Hill et al, (2019) (see Appendix B), was to evaluate if tailored falls prevention education delivered at point of discharge in addition to usual care, reduces fall rates in older adults after discharge home from hospital. The education intervention was developed using the framework of the Capability Opportunity Motivation Behaviour (COM-B) model of health behaviour change (Michie, van Stralen, & West, 2011). The aim of the education was to increase engagement in falls prevention strategies; therefore,

it was important to understand the intended effect on the intermediate outcome of engagement in falls prevention strategies. It was yet to be determined if providing tailored falls prevention education can facilitate capability, opportunity, and motivation for older adults to engage in falls prevention strategies at home after hospital discharge. (Figure 3.1)

3.2.1 Study Aims

The primary aim of this research was to evaluate the impact of tailored fall prevention education provided at hospital discharge in addition to usual care, on older adults' engagement in falls prevention strategies in the six months after hospital discharge (Study 1, Chapter 4). This was to be compared to control conditions. The secondary aims were a) to evaluate older adults' capability, and motivation, to engage falls prevention strategies for those participants who received tailored falls prevention education in addition to usual care, compared to those that received a social/control intervention in addition to usual care (Study 2, Chapter 5); and b) to identify the opportunity (social and physical environment) surrounding the participant that made the behaviour possible, by exploring the barriers and facilitators identified by older adults to engage in falls prevention strategies in the six months following hospital discharge (Study 3, Chapter 6).

3.3 Methods

3.3.1 Design

The design comprised a process evaluation of an RCT conducted in Perth, Australia (Hill et al., 2019, see Appendix B). A convergent embedded mixed method design was used (Creswell, 2014). Quantitative data regarding participants' engagement in fall prevention strategies (Study 1, Chapter 4), and their capability and motivation to engage in fall prevention were gathered at baseline and at six months post discharge using structured surveys (Study 2, Chapter 5). Qualitative data were collected using semi-structured telephone surveys for a purposive sample at six months post discharge (Study 3, Chapter 6). Both quantitative and qualitative data were triangulated and mapped to participants' capability, opportunity and motivation, to enable a deeper interpretation of the impact of the education on their fall prevention behaviour (Synthesis, Chapter 7). Measuring engagement is a complex concept (Craig et al., 2008). By using triangulation to describe the effects of the education on engagement in falls prevention strategies through both quantitative and qualitative data sources, this aimed to provide a more holistic understanding of the phenomena (Jones & Bugge, 2006; Liamputtong, 2013).

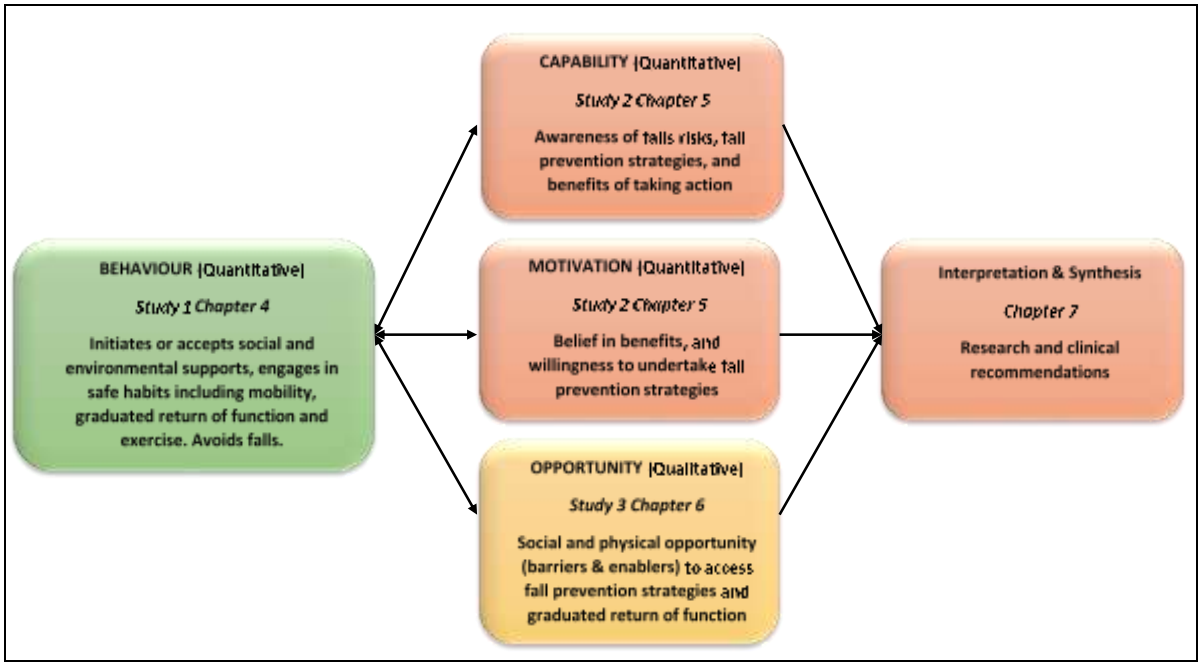

Figure 3.1 COM-B model applied to evaluation of tailored fall prevention education

3.3.2 Ethical considerations

Ethics approvals for the research conducted as part of this thesis had been obtained from Human Research Ethics Committee of North Metropolitan Health Service and South Metropolitan Health Service with reciprocal approval from The University of Notre Dame Australia and Curtin University. Participant information forms were provided at the time of consent at baseline in hospital as a part of the RCT and all participants provided written informed consent to participate in the study. The "Back to My Best" clinical trial was registered through Australian New Zealand Clinical Trials Registry (ACTRN12615000784516). Ethics for each publication is presented in the chapters.

3.3.3 Patient involvement

Patients were not directly involved in the design of this process evaluation. Participants were informed at enrolment that they could elect to receive a plain language summary of results when the process evaluation was completed, each participant was reminded of this during the final phone call contact with researchers. Participants were acknowledged and thanked for their contributions during the publication and distribution of results.

3.3.4 Overall procedure

An overview of the research procedure for primary and secondary quantitative and qualitative data collection and statistical analysis is presented in Figure 3.2.

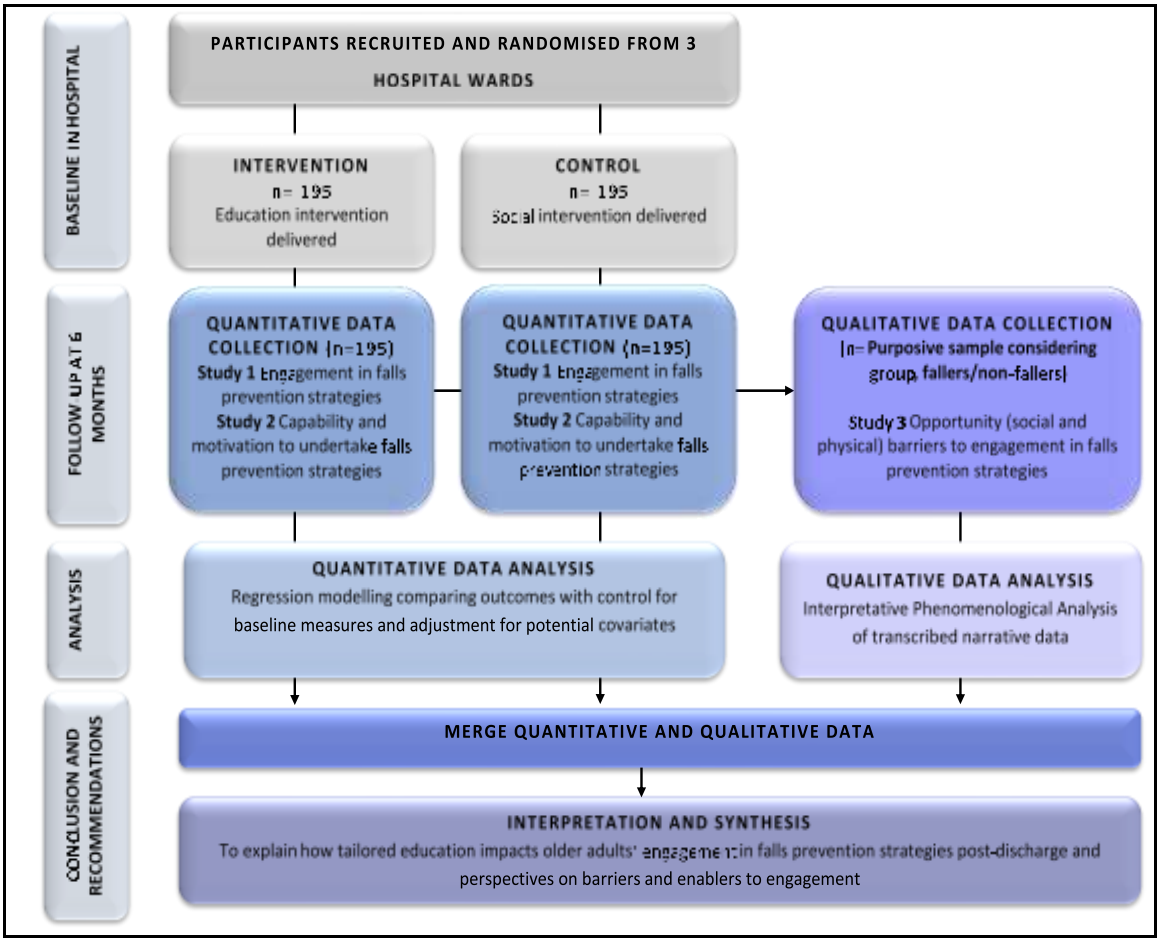

Figure 3.2 Procedure

3.3.5 Setting and participants

Participants (n=390) were older people discharged from one of three rehabilitation hospitals in Perth Western Australia between August 2015 and September 2017 and followed for six months after discharge. These wards admit patients with a variety of diagnoses, such as osteoarthritis, recent stroke, Parkinson's disease, dementia, recent orthopaedic or general surgery, or recovering from a general medical condition. Participants recruited in hospital provided written informed consent and then randomly assigned (concealed) to either the intervention group or the control group prior to discharge (Hill et al., 2019).

3.3.6 Inclusion and exclusion criteria

Inclusion criteria for the RCT were that participants must be 60 years of age or older, and had cognitive function rated >7/10 in Abbreviated Mental Test Score (AMTS) (Hodkinson, 2012) (Hill et al., 2019). All participants contributed data for this process evaluation. Patients were excluded from enrolment if they had an unstable medical condition; discharged to a transitional or residential care setting or requiring palliative care.

3.3.7 Education intervention

The education design was based on the health behaviour change theory that conceptualizes behaviour change is generated from an interaction of an individuals' capability, opportunity, and motivation to perform the behaviour (COM-B) (Michie, van Stralen, & West, 2011). The complex health behaviour change intervention (Michie, Fixsen, Grimshaw, & Eccles, 2009), 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 behaviour changes). The benefit of utilising the COM-B framework in this evaluation, was it recognizes that the desired behaviour arises from combinations of any of the components of the framework, and this differs for each participant according to the context of their personal circumstances and recovery after hospital discharge (Michie, van Stralen, & West, 2011).

The education 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 (Hill, Etherton-Beer, et al., 2013). Education was delivered by an experienced physiotherapist on a one-to-one basis at the patients' bedside while in hospital, using a workbook, video, and individual discussions (Hill et al., 2019). Tailoring the education was a behaviour change technique that involved personalising the fall prevention strategies based on participants' experiences and preferences, followed-by individualized goal setting, and action

planning for their imminent discharge home. The fall prevention strategies promoted during the education were to facilitate a gradual and safe recovery and may have included seeking assistance with activities of daily living, modification of home hazards, and safe completion of exercise. Following hospital discharge, once per month for 3 months, those participants in the intervention group received a coaching phone call from the same therapist to reinforce behaviour change, provide feedback, problem-solve barriers to change, and modify their action plan accordingly. Further description of the education is also presented in Appendix B.

Those participants in the control group received a social intervention in hospital delivered by a different trained health professional who discussed aspects of positive ageing using a scripted program at the same dose/frequency as the intervention group, without coaching phone 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.

3.3.8 Outcome measures

3.3.8.1 Quantitative

Primary outcome: engagement in fall prevention strategies in the six months after discharge. Fall prevention strategies measured were those suggested to the participant as a part of the tailored education intervention, which was based on current evidence for fall prevention, provided prior to discharge. Each participant was encouraged to engage in a fall prevention plan which was tailored by the delivering therapists. This intervention has been described in full elsewhere (Hill et al., 2019). Strategies were defined as:

i. Receiving assistance (both formal and informal assistance) with activities of daily living (ADL). Activities of daily living were defined according to the Katz index

of Independence in Activities of Daily Living (Katz, 1983), and included toileting, showering, and eating.

ii. Receiving assistance with instrumental activities of daily living (IADL). Instrumental ADL were defined using the Lawton index (Lawton & Brody, 1969), and included home cleaning, shopping, and transport.

These two outcomes were measured using yes/no responses and frequency (days per week and hours of total assistance per week) and type of assistance (whether paid formal services from home care provider or informal family or friends' assistance to the participant).

iii. Engagement in exercises, including all type (such as a strength and balance exercise program, group exercise, swimming, golf, tai chi, walking, dancing), whether a balance component was included, and frequency (hours per week and number of times per week) and where completed such as at home, in a healthcare centre, with or without health provider assistance.

iv. Home modifications, such as installation of equipment or rails, or alteration of home layout, including whether assessment was provided by an occupational therapist and the level of assistance obtained to make these modifications.

These primary outcomes were measured in hospital (baseline) by recruiters for the RCT (who are blinded to group allocation), then measured at six-months following hospital discharge through a structured phone survey by a trained research assistant who was also blinded to group allocation. These surveys had been modified from previous surveys used in falls prevention trials, including the pilot trial which evaluated these outcomes (Hill et al., 2013; Hill et al., 2011; Hill et al., 2015).

The secondary quantitative outcome measures were:

i. Participants perceived levels of capability (knowledge and awareness) about falls prevention after discharge, such as awareness of risk of falls, awareness of injury and benefits of engaging in falls prevention strategies; measured through a

structured phone survey using Likert scales (Hartley, 2014), at baseline and at six-month follow up.

ii. Motivation, such as beliefs in benefits of engaging in fall prevention, confidence to engage strategies; and to develop and enact a plan to engage strategies.

These secondary outcomes were measured alongside the primary outcomes, using the methods described above. Survey items for secondary outcomes were measured using five-point Likert scales (Hartley, 2014), (strongly agree to strongly disagree). Items were based on the domains of the COM-B (Michie, van Stralen, & West, 2011), and modified from previous surveys which have evaluated capability and motivation regarding falls prevention (Hill et al., 2013; Hill et al., 2011; Hill et al., 2015).

iii. Motivation to engage in exercise was additionally measured using the Self-Efficacy for Exercise scale (SEE) (Resnick & Jenkins, 2000), a 9-item scale that rated older peoples' response to a statement about barriers to exercise (scores range from 0=not very confident to 10=very confident; with a total possible score of 90).

3.3.8.2 Qualitative

The secondary qualitative outcomes related to opportunity (described as being both social and physical in the COM-B framework) (Michie, van Stralen, & West, 2011), and included both barriers and enablers that participants encountered when seeking to engage in falls prevention strategies. These secondary outcomes were measured by completing semi-structured in-depth phone interviews at the conclusion of the observation period. Questions were guided by participant responses gained from earlier structured phone interviews, using open-ended questions designed to encourage the participants to reflect on their previous responses. Questions were framed around barriers and enablers to engaging in falls prevention strategies, graduated return to independence, and exercise. This may have been physical opportunity provided by their environment including access, social supports, or cultural milieu including stigmas or fears that dictated decision-making (Michie, van Stralen, & West, 2011).

Demographic data were gathered in hospital at baseline by recruiters during a face to face interview. These data included age, gender, diagnosis, length of stay in hospital, history of falls prior to hospitalisation and during hospital stay, presence of visual impairment, presence of hearing impairment, number and type of medications, signs of depression (measured using Geriatric Depression Scale) (Yesavage et al., 1982), and use of walking aids.

Other data was also collected at baseline during the face to face interview then again at six-months after discharge using a structured phone survey. These variables were living situation (home alone, with partner, other situation), level of indoor and outdoor mobility, including any use of walking aids, functional mobility measured using Katz and Lawton's Scales (Katz, 1983; Lawton & Brody, 1969), and health related quality of life measured using the Assessment of Quality of Life tool (AQoL) (Richardson et al., 2012).

Additionally, as part of the education intervention, data were collected regarding the delivery of the program by the educators. These data included the number of education sessions provided to each intervention group participant, the duration, and whether an action plan was completed. These data were used during sensitivity analyses, to assist to explain participants' knowledge, motivation, and engagement in falls prevention strategies after discharge.

3.3.9 Data collection and procedure

Baseline surveys for primary and secondary outcomes were conducted by a trained research assistant who was blinded to group allocation, then participants were randomly allocated to intervention or control group. The RCT protocol, including randomisation, blinding, and the intervention procedure has been described in detail elsewhere (Hill et al., 2019). Briefly, participants received tailored falls prevention education by trained physiotherapist educators during a one-to one interaction in hospital. The education assisted the participant to prepare a tailored plan to initiate after hospital discharge. The participants

were then followed up by phone after discharge, by the same educators once a month for three months, to further assist them to enact their plan, and address any barriers that may have arisen since discharge.

At six-months following hospital discharge, the structured phone survey was conducted to collect quantitative follow up data, after which the participant was invited to participate in a semi-structured in-depth phone interview to collect qualitative data that measured the secondary outcome which explored opportunity to engage in falls prevention strategies.

Purposive sampling for qualitative data collection occurred after the six-month period and following completion of primary and secondary quantitative data collection. The sample selected represented the cohort, with consideration of age, diagnosis, gender, falls history, and whether intervention or control group. Purposive sampling was finalised and justified by referring to data and theoretical saturation and confirmed through consensus of a second researcher reviewing the transcribed narrative data (Braun & Clarke, 2014). A phone interview was selected to collect data, rather than a focus group, or face to face interview, as the participants had previously received monthly phone monitoring of falls data from the RCT, so the researcher has established a genuine rapport and reciprocity with the participants (Creswell, 2012). To ensure quality data collection to answer the study aim, the semi-structured survey had been piloted to ensure the questions were easily understood and screened for blind spots, bias, and potentially sensitive questions (Liamputtong, 2013). Each interview was recorded and transcribed verbatim. Additional interviews were completed as necessary until data saturation has occurred. The researcher kept a journal to record observations and reflections regarding data collection and procedure.

3.3.10 Statistical analysis

3.3.10.1 Quantitative data

Quantitative data were analysed using Stata (Stata Statistical Software: College Station, TX: StataCorp LP) and intention to treat analysis was undertaken when examining potential influence of group allocation on process outcomes based on the trial randomization (Gupta, 2011). Primary and secondary outcomes were summarized using descriptive statistics. The primary analysis compared engagement with each strategy between the control and intervention groups for six months post-discharge from hospital, using regression models that controlled for baseline measures of engagement and conducted with adjustment for potential covariates consistent with the prior pilot study for the trial (Hill et al., 2013). Similarly, secondary analyses compared the secondary outcomes to examine potential between group differences using regression models that controlled for baseline and conducted with adjustment for potential covariates consistent with the prior pilot study for the trial (Hill et al., 2013), such as previous history of falls, visual impairment, use of a walking aid, and living alone Sensitivity analyses was also conducted to examine whether the trial findings were robust to planned analysis choices (e.g., intention-to-treat versus as treated analyses, or adjusted versus unadjusted regression models). The significance level for analyses was set at 0.05, and the sample size was determined by primary trial effect analysis (Hill et al., 2017).

3.3.10.2 Qualitative data

Qualitative data from researcher field notes, phone interview transcriptions and participant open-ended answers to structured questions in the quantitative survey were used, with the intent to triangulate the different data sources and gain a multi-layered understanding of the findings (Jones & Bugge, 2006). Interpretative phenomenological analysis (IPA) was used to describe and interpret participants' behaviours regarding engagement in falls prevention strategies (Smith, Flowers, & Larkin, 2009). To account for the potential wide range of emergent barriers and enablers likely to affect participants' fall prevention

engagement in the context of their life-circumstances after hospital discharge required the use of the Theoretical Domains Framework (TDF) that is linked to the COM-B model (Cane, O'Connor, & Michie, 2012). The framework contains the COM-B components within 14 domains and has previously been used as a basis to understand the effects of behaviour change interventions (Francis, O'Connor, & Curran, 2012). Following IPA guidelines, the two researchers independently produced detailed interpretative coding of how and why the participants experienced barriers or enablers to engaging in fall prevention strategies since hospital discharge. These coded data were then examined by the two researchers together to identify emergent themes then re-examined to ascertain if it described the data collected and if all coded data were captured within these identified emergent themes (Smith, Flowers, & Larkin, 2009). Member-checking occurred by the first researcher returning to a sample of participants to ask them how accurately their realities had been represented in the final interpretations (Braun & Clarke, 2014). To add rigor, a third researcher who was not involved in data collection, was then invited to scrutinize the data and to arbitrate any differences between coding and themes, and review final interpretations (Smith, Flowers, & Larkin, 2009). Purposive sampling for qualitative data collection were finalised and justified by consensus between all three researchers referring to the findings to confirm saturation of themes (Smith, Flowers, & Larkin, 2009).

Finally, quantitative and qualitative data were synthesised to enrich the interpretation of the findings with the aim of adding validity to the study (Braun & Clarke, 2014). An overview of the procedure for primary and secondary quantitative and qualitative data collection and statistical analysis is presented in Figure 3.2.

3.4 Discussion

Recent studies investigating readmissions have found that patients are unprepared to manage their physical limitations during their immediate recovery after hospital discharge (Covinsky, Pierluissi, & Johnston, 2011; Greysen et al., 2016). These investigations have shifted from a hospital-centric model to a patient-centred approach to understand the lived experience of older adults as they transition from hospital to home (Andreasen, Lund, Aadahl, & Sørensen, 2015; Howard-Anderson et al., 2014). This is important because other systematic reviews of discharge planning have identified that while readmissions may be reduced with such interventions, the impact on health outcomes for the patients is uncertain (Gonçalves-Bradley et al., 2016).

Previous observational studies have suggested that to promote participation in evidenced-based falls prevention strategies, therapists may need to convince older adults that they are at risk of falls (Haines et al., 2014), with guidance on what specific strategies are likely to have a personally beneficial falls prevention effect (Mihaljcic et al., 2017). Tailored health education aims to change individuals' health behaviours (Michie van Stralen, & West, 2011). When this education is used as an intervention, it presents a challenge for identifying effective components, and therefore reporting of findings, and subsequent replication (Craig et al., 2008).

This process evaluation sought to understand whether providing tailored education facilitates older adults' engagement in falls prevention strategies after hospital discharge. The application of the COM-B model to the findings (Michie, van Stralen, & West, 2011), assisted to characterise how the intervention altered motivation, capability or opportunity. Additionally, secondary analysis of barriers or enablers to engagement were mapped onto the COM-B model to subsequently identify more precise determinants of engagement (Michie, 2014). Capability included an individual's psychological and physical capacity to engage in

falls prevention strategies behaviour. Opportunity, both social and physical, included those factors that lie outside the individual that make the behaviour possible, such as being able to access home assistance or modifications. Motivation included all processes that inspire and direct behaviour, such as believing that it would be good to complete exercise.

This proposed research had strengths and limitations that warranted consideration. The participants were a broad cohort recruited from a representative sample of three public metropolitan rehabilitation hospitals in Australia. The delivery of a falls prevention education intervention just prior to discharge with follow-up sessions by telephone during one month after hospital discharge had previously shown promising effects on older adult engagement in falls prevention strategies in a pilot trial (Hill et al., 2013). Other strengths included the prospective design, robust data collection and the convergent embedded mixed method design, which combined the advantages of both quantitative and qualitative data (Creswell, 2012).

A possible limitation was that the participants had been drawn from a high-risk population that may still have been affected by their illness. To minimise bias through possible prompting of participants, data regarding engagement in falls prevention strategies following hospital discharge, were not collected until six months post-discharge. We were also relying on self-reported data at six months. Participants were only contacted by phone and not interviewed face to face, however we found in earlier trials that this allowed more complete responses as older people, especially if unwell, are not always able to attend a clinic setting (Hill et al., 2013; Hill et al., 2011).

3.4.1 Conclusion

This process evaluation planned to assess older adults' response to a tailored falls prevention education programme and investigated how the intervention was received and interpreted by the older participant during their post-discharge recovery. When delivering interventions that seek to facilitate health behaviour change, it was also important to

understand the process by which behaviour changes and the mediating factors (Abraham et al., 2015). This provides evidence to develop a sound basis for defining effective intervention components (Michie et al., 2015). I planned to clarify whether providing tailored falls prevention education can positively change health behaviour. I also wanted to explore older adults' knowledge of falls prevention strategies and motivation to engage falls prevention strategies following hospital discharge. Findings would enable generation of robust recommendations for clinicians and researchers about the role of tailored falls prevention education at the point of hospital discharge. Ultimately, I aimed to understand if providing older adults with tailored education enables them to change their health behaviour in the post discharge period and if engagement in relevant strategies reduces falls after hospital discharge.

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CHAPTER 4 STUDY 1: Evaluation of Tailored Falls Education on Older Adults' Behaviour Following Hospitalisation

Preface

As an evaluation of a behaviour change intervention, it was first important to quantitatively measure and compare fall prevention behaviour between those participants who received the education, and those in the control group. This chapter reports the impact of the tailored education intervention on participant's level of engagement in fall prevention strategies within six-months after discharge home from hospital. The chapter is based on a published article.

Naseri, C., McPhail, S. M., Haines, T. P., Morris, M. E., Etherton-Beer, C., Shorr, R., Flicker, L., Balsara, M., Netto, J., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A.-M. (2019). Evaluation of tailored falls education on older adults' behaviour following hospitalisation. *Journal of the American Geriatrics Society*, *00*, 1-8. doi:10.1111/jgs.16053

4.1 Abstract

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

Methods and analyses: A process evaluation of an RCT that aimed to improve older adult fall prevention behaviours after hospital discharge. Participants (n=390) were aged 60 years and over with good cognitive function (>7/10 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 analysed using generalized linear modelling.

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 levels of engagement in fall prevention strategies, including receiving ADL assistance [AOR 1.3 (95%CI 0.7, 2.1), 0.3], completion of home modifications [AOR 1.2, (95%CI 0.7, 1.9), 0.4], and exercise [AOR 1.3 (95%CI, 0.7, 2.2), 0.3]. There was a high proportion of unmet needs within both groups, as more than 60% of participants within both groups did not receive ADL assistance after discharge, and an increase in the level of assistance required to complete activities of daily living from 15% being dependent at baseline (admission) compared to 30% at six months follow-up (AOR 1.4, 95%CI 0.8-2.0, p<0.00). 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 at follow-up (SD =1.12).

Conclusion: Tailored education did not increase older adult engagement in fall prevention strategies after hospital discharge compared to usual care. Further research was required to determine if the education affected participants' capability and motivation to engage in fall prevention strategies after they were discharged home.

4.2 Introduction

Interventions delivered around the time of hospital discharge are designed to prepare patients for their transition home (Goncalves-Bradley et al., 2017; Greysen et al., 2016). They are argued to reduce adverse events, such as falls and rehospitalisation (Mistiaen, Francke, & Poot, 2007), when provided over an extended period once patients return home from hospital (Braet, Weltens, & Sermeus, 2016), and when focused on building patient capacity for self-care (Cheal & Clemson, 2001).

Education that is tailored to the older patient has been recommended for improving health behaviours and capacity for self-care during hospital to home transitions (Leppin, Gionfriddo, Kessler, & et al., 2014). However, the evidence of effectiveness of education for prevention of falls has been mixed (Lee, Pritchard, McDermott, & Haines, 2014). A ward-based falls education program reduced inpatient falls incidence by improving fall prevention behaviours on hospital wards (Haines et al., 2011; Hill et al., 2015), while a pilot trial of a tailored falls education program delivered prior to discharge, improved fall prevention behaviours and reduced incidence of falls within the first month following hospital discharge (Hill, Etherton-Beer, & Haines, 2013). 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 six-month period following hospital discharge (Hill et al., 2019). Since the discharge intervention was designed to facilitate changes in older patient' health behaviours over an extended period after hospital discharge (Hill et al., 2017), a process evaluation was necessary to understand if the intervention had the intended effect of promoting engagement in fall prevention behaviours in the context of their life-circumstances following hospitalisation (Moore et al., 2015).

The aim of this study was to evaluate the impact of tailored falls education intervention in addition to usual care, on older adult engagement in fall prevention strategies within six-months after hospital discharge, compared to those who received a social intervention in addition to usual care (Naseri et al., 2018).

4.3 Methods

4.3.1 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.

4.3.2 Design

A process evaluation 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 post-hospitalisation falls incidence by facilitating older adults to initiate and sustain engagement in personalized fall prevention strategies (Hill et al., 2019). The protocol for this process evaluation has been previously described in detail (Naseri et al., 2018).

4.3.3 Participants and setting

Participants were patients aged 60 years or older, from one of three rehabilitation hospitals in Perth Western Australia between August 2015 and September 2017 and followed for six months after discharge (Hill et al., 2019). Patients were admitted to hospital wards with a variety of diagnoses, including stroke, recent orthopaedic, general surgery, or general medical conditions. Included participants had good cognition (scored greater than 7/10 using the Abbreviated Mental Test Score) (Hodkinson, 2012) and were discharged to the community.

4.3.4 Education intervention

The education intervention, which has been described in full previously (Hill et al., 2019; Naseri et al., 2018), was based on a pedagogically sound program found to be effective in improving knowledge, confidence and motivation for older patients to engage in falls prevention strategies after hospital discharge (Hill et al., 2013). The program was planned to

take between 2 and 4 sessions to deliver in an estimated total time of 45 minutes. The education was delivered by physiotherapists and included providing written and video materials followed by individualised discussion. The education content was based on the principles of health behaviour change, with messages that included falls prevention strategies tailored for each participant, such as instructions on how to engage in exercise according to their capability, to modify home hazards, to use their walking aid, to return to normal function, and how to seek assistance if required for home tasks or personal care.

The control group received a social intervention, between 1 and 3 sessions (estimated total time of 45 minutes) with a trained health professional who discussed aspects of positive ageing using a scripted program, without any fall prevention information.

The intervention was delivered in addition to usual inpatient care, including discharge planning, falls education, home-visits and equipment provision, and addition of social supports (Hill et al., 2019).

4.3.5 Outcomes and procedure

The outcomes for the process evaluation that have previously been described (Naseri et al., 2018), were engagement in fall prevention strategies, defined as:

i) formal assistance received from a formal paid homecare provider with activities of daily living (ADLs), for example bathing, dressing, and eating; or instrumental activities of daily living (IADLs), like cleaning and shopping;

ii) informal assistance from family or friends with ADLs, or IADLs. ADLs were defined according to the Katz Index of Independence in Activities of Daily Living (Katz, 1983), and IADLs using the Lawton Instrumental Activities of Daily Living scale (Lawton & Brody, 1969);

iii) completed formal home modifications as recommended by an occupational therapist (OT) and included installation of grab rails and provision of equipment; or informal

home modifications by family/friends/participants themselves, including alteration of the home layout, removal of home-hazards;

iv) completed exercise, 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 by an OT around the time of discharge.

Outcomes were measured by conducting face to face structured interviews at baseline in hospital, then repeated at six-month post-hospitalisation using structured phone interviews. At baseline, engagement in fall prevention strategies completed prior to hospital admission was measured. At six-month follow-up, engagement over the six-months since hospital discharge was measured. All outcomes were measured categorically/binomially, while exercise and assistance with ADL/IADLs had the additional measure of frequency (per week) and duration.

4.3.6 Statistical analysis

Data were analysed using Stata release 15.1 (StataCorp, College Station, Texas, 2017) and intention to treat analysis 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 or Chi-squared tests. Participants' level of ADL dependence was measured at baseline and six-months follow-up using Katz scores, where 0-2=severe dependence, 3-4=moderate dependence, 5-6=independent (Katz, 1983). The differences between groups in the number of participants engaging in fall prevention strategies after discharge was evaluated using mixed effects generalized linear models with adjustment for baseline values of these variables, and results presented as adjusted odds ratios (AOR) with 95% confidence intervals (CI). To account for potential clustering within hospital facilities, site was included as a random effect in each model. Significance was set to $p<0.05$ for all inferential analyses. To examine whether findings were robust based on choice of analytical approach, a sensitivity analysis was conducted

whereby generalised estimated equations with compound symmetry were used rather than mixed effects generalised linear models. However, findings were consistent regardless of analytical approach (including similar p-values and confidence intervals), consequently, only the pre-specified analyses were reported.

4.4 Results

4.4.1 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 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 site 1, n=124 site 2, n=120 site 3). The flow of participants through the study is shown in Figure 4.1. During the six-month follow-up period, 48 (12%) participants were lost to follow-up, the most frequent reason being death (30 participants). At six months post-hospitalisation, 334 (87.4%) participants were available to complete the final survey. Of these, 38 participants had been admitted to nursing homes during the follow-up period and were not available to interview, and 4 participants 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 4.1. There were no significant differences between the two groups.

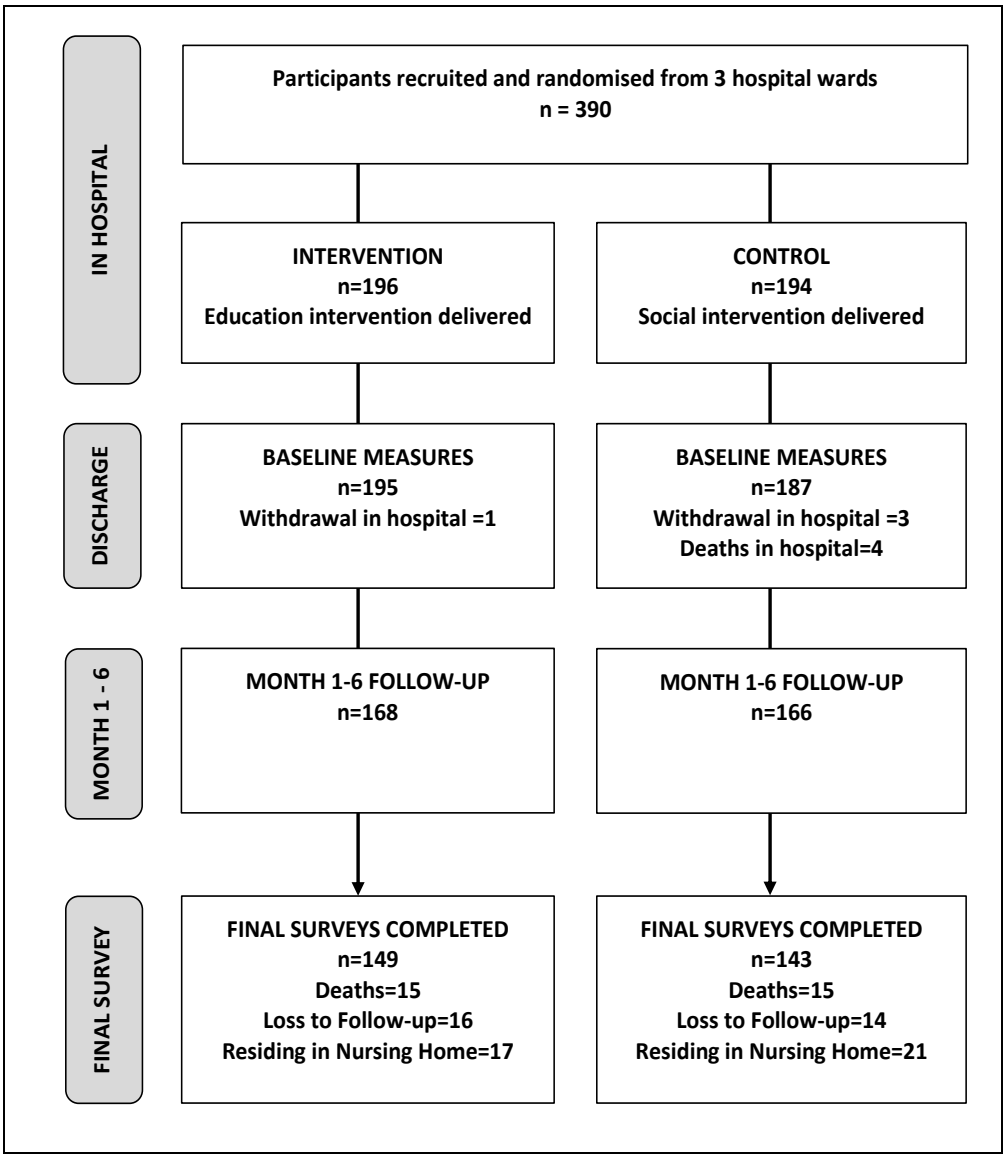

Figure 4.1 Participant flow through the study

Table 4.1. Demographic characteristics of participants

Variable [a]	Intervention n=149	Control n=143
Age, mean (SD)	77.2 (8.9)	77.9 (8.4)
Gender Female	90 (60.4)	95 (66.4)
Length of stay in hospital (days): median (IQR)	24 (43-16)	24 (35-18)
Diagnosis		
Neurological	22 (14.7)	26 (18.2)
Musculoskeletal	23 (15.4)	20 (14)
Orthopaedic	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 [b]	44 (29.5)	35 (24.5)
Hospital admission in 1 year prior to current	54 (36.2)	67 (46.8)
Fell in 6 months 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[c]	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[d] median (IQR)	4 (5-2)	3 (5-2)
Depressed mood GDS <5[d]	0.2 (0.4)	0.24 (0.4)
AQoL[e] mean (SD)	0.6 (0.1)	0.6(0.1)
ADL Function at discharge		
Katz[f] median (IQR)	5 (6-3)	5 (6-3)
Lawton's [g] median (IRQ)	7 (8-5)	7 (8-6)

Note. **a** all data is measured in n(%) unless otherwise stated **b** glaucoma, cataracts, macular degeneration; **c** Transitional Care or Nursing Home **d** Geriatric Depression Scale Short Form, score ≥ 5 suggests depression **e** AQoL-6D utility instrument **f** Katz Index of Independence in Activities of Daily Living, range 0-6 greater score indicates more independence **g** Lawton's Instrumental Activities of Daily Living, range 0-8 greater score indicates more independence

4.4.2 Engagement outcomes

Table 4.2 presents the number and proportion of participants in intervention and control groups who engaged in fall prevention strategies at six-months follow-up and baseline, with adjustment for baseline engagement during analysis. 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 receiving formal (paid) and informal assistance with activities of daily living (ADLs) at six-month follow-up compared to baseline. The absence of assistance with ADLs in the presence of disability is described as unmet ADL needs (Hass et al., 2017). There were more than 60% of participants within both groups (intervention= 74, control= 64) who were not receiving assistance with ADLs at six-month follow-up. Participant dependency with ADLs, measured using Katz scores (0-2=severe dependence, 3-4=moderate dependence, 5-6=independent) (Katz, 1983), was found to be significantly higher in both groups at hospital discharge (AOR 0.6, 95%CI 0.3, 1.0, p<0.00) and six-month follow-up (AOR 1.4, 95%CI 0.8, 2.0, p<0.00), compared to hospital admission (Figure 4.2). At baseline 15% of participants in both groups had moderate to severe dependency when completing their ADLs. At discharge from hospital more than 50% of participants in both groups had moderate or severe dependency, and at six-month follow-up more than 30% of participants in both groups were still at these levels of dependency when completing their ADLs.

Forty percent of participants within both groups (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 after hospital discharge, (intervention= 43, control= 29).

Figure 4.3 presents exercise engagement results, including proportion of the population who were exercising at six 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, the majority (60%) exercised for short doses of 1 hour or less per week, which was distributed over a range of 2-7 sessions per week.

Table 4. 2. Engagement in fall prevention strategies within six months of hospital discharge

Fall prevention strategies [a]	Intervention		Control		Adj [b] OR [c], (95% CI [d]), *p*-value	b Coefficient [e], (95% CI), *p*-value
	Baseline n=194	6 Months n=149	Baseline n=188	6 Months n=143		
Received formal [f] ADL[g] assistance	31 (15.9)	52 (34.9)	23 (12.2)	47 (32.8)	1.0 (0.6, 1.8), 0.8	
Frequency [h]						0.2 (-0.3, 0.7), 0.4
< 3 days	25 (12.9)	32 (21.5)	20 (10.6)	40 (27.9)		
≥ 3 days	3 (3.0)	20 (13.4)	3 (1.6)	7 (4.9)		
Received informal [i] ADL assistance	16 (8.2)	44 (29.5)	22 (11.7)	55 (38.4)	0.7 (0.4, 1.2), 0.2	
Frequency						-0.4 (-0.8, 0.1), 0.1
<3 days	6 (3.2)	22 (14.7)	7 (3.6)	24 (16.8)		
≥3 days	9 (4.6)	22 (14.7)	16 (8.5)	31 (21.7)		
Received formal IADL[j] assistance	85 (43.8)	88 (59.0)	95 (50.5)	82 (57.3)	1.3 (0.7, 2.1), 0.3	
Frequency						0.3 (-0.1, 0.8), 0.1
< 3 days	84 (43.8)	78 (52.3)	94 (49.9)	76 (53.1)		
≥3 days	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, 1.2), 0.2	
Frequency						-0.3 (-0.7, 0.1), 0.2
< 3 days	55 (28.3)	68 (45.6)	66 (35.1)	71 (49.6)		
≥3 days	43 (22.1)	27 (18.1)	36 (19.15)	31 (21.6)		
Completed formal [k] home modifications	114 (58.7)	87 (58.4)	123 (65.4)	77 (53.8)	1.2 (0.7, 1.9), 0.4	
Number, median (IQR)	1 (0-2)	1 (0-2)	1 (0-2)	1 (0-2)		0.02 (-0.2, 0.2), 0.8
Completed informal [l] home modifications	189 (97.9)	57 (39.8)	185 (98.4)	59 (39.6)	1.0 (0.6, 1.6), 0.9	
Number, median (IQR)	1 (1-1)	0 (0-1)	1 (1-1)	0 (0-1)		1.0 (0.6, 1.6), 0.9
Received OT home visit	78 (40.4)	95 (63.7)	62 (32.9)	89 (62.2)	1.0 (0.6, 1.6), 0.9	
Completed any exercise[m]	73 (37.6)	111 (74.5)	79 (42.0)	101 (70.6)	1.3 (0.7, 2.2), 0.3	
Sessions [n] per week, median (IQR)	5 (3-5)	4 (2-7)	5 (2-5)	3 (2-7)		-0.05 (-0.2, 0.1), 0.5

Hours per week, mean (SD)	3.1 (1.9)	0.9 (0.9)	2.8 (2.2)	1.1 (1.3)	-0.3 (-0.7, 0.06), 0.1

Note. a All data is n (%) unless otherwise stated **b** Adjusted for baseline values, time in study, and hospital site **c** Odds ratio **d** Confidence Interval **e** Coefficient of change **f** formal paid homecare provider **g** activities of daily living defined using Katz Index **h** assistance/week **i** Assistance from family or friends **j** Instrumental activities of daily living, defined using Lawton Index **k** modifications provided by occupational therapist **l** undertaken by family or friends **m** individual, or group program, or walking **n** number of times completed any exercise per week

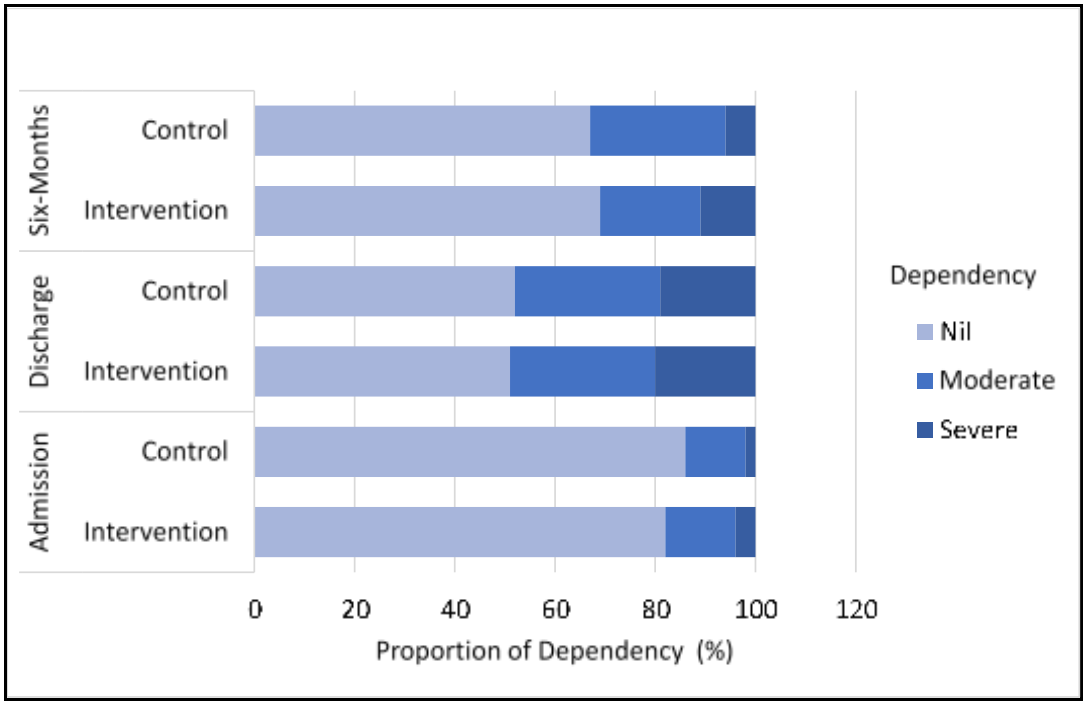

Figure 4.2 Proportion of dependency within six months of hospital discharge

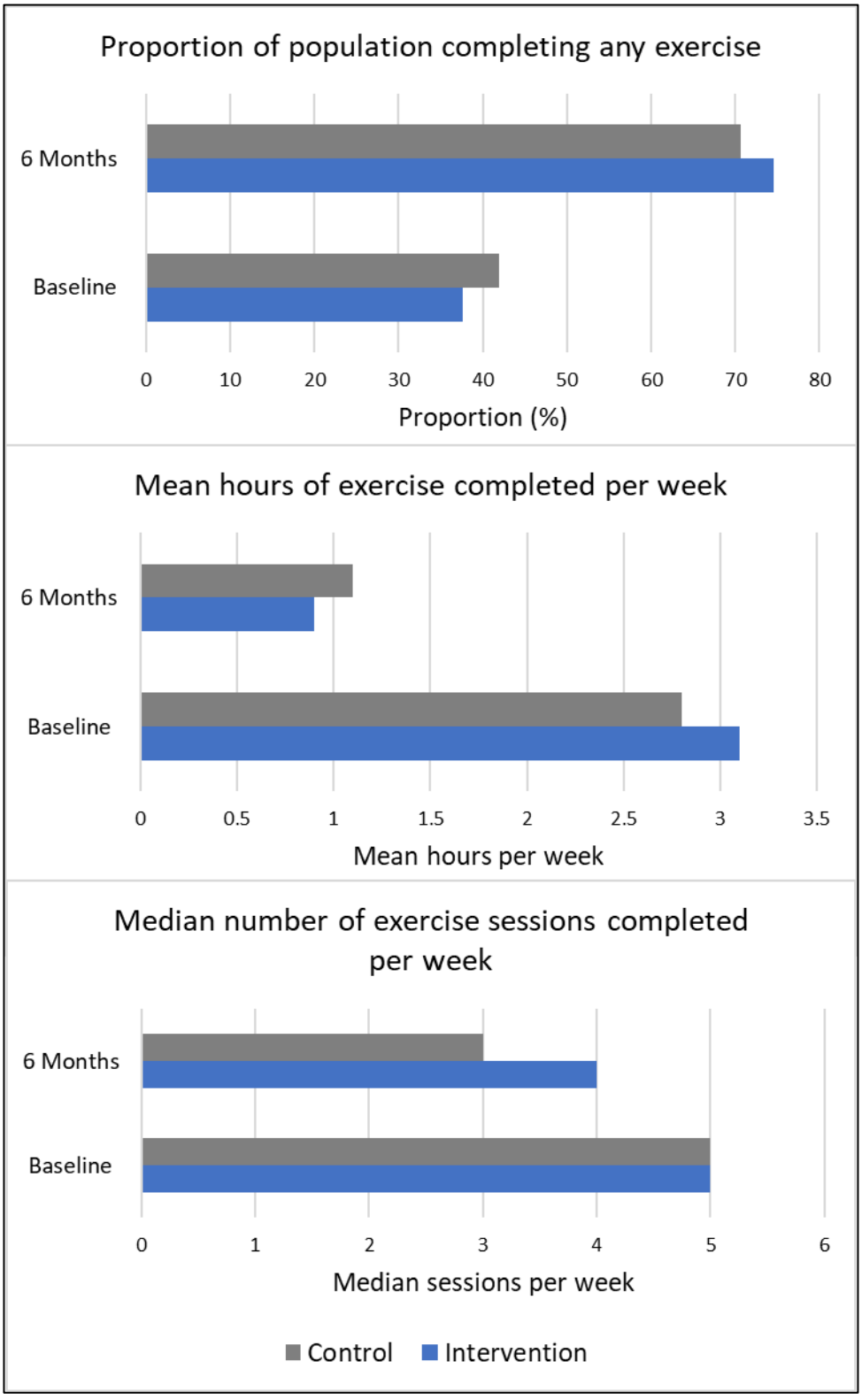

Figure 4.3 Engagement in exercise within six months of hospital discharge

4.5 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 six-months after hospital discharge. This lack of intervention effect was consistent with findings of the main trial (Hill et al., 2019). During the six-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 hospital (Haines et al., 2009; Hill, Hoffmann, McPhail, Beer, Hill, Oliver, et al., 2011), in which participants are characterized by reduced function and multi-morbidity (Elley et al., 2008; Sherrington et al., 2014).

Similar to previous pragmatic education evaluations (Hill, Etherton-Beer, et al., 2013; Hill et al., 2015), this trial evaluated an intervention scalable to existing hospital discharge resources (Haines et al., 2013). The tailored education program was comprehensive and aimed to promote safe hospital transitions by developing participant capability and motivation to undertake an action plan once they were discharged home from hospital (Hill et al., 2019). 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 behaviours from the time older adults returned home from hospital, and over the six-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 (Covinsky, Pierluissi, & Johnston,

2011), and the difficulties of compensating for their functional limitations during recovery (Gill, Allore, Gahbauer, & Murphy, 2010; Krumholz, 2013). A large proportion (66%) of participants from both groups were found to not receive assistance with ADLs at six-months following hospital discharge, indicating they may not have taken the time to gradually re-commence their usual daily activities in a safe manner (Hill, Hoffmann, & Haines, 2013; Hill, Hoffmann, McPhail, Beer, Hill, Oliver, et al., 2011). An indication that participants did not regain their function after hospital discharge, were in raised dependency trends at six-month follow-up compared to baseline (see Figure 4.2). An indication that participants did not regain their function after hospital discharge, were in raised dependency trends at six-month follow-up compared to baseline (see Figure 4.2). Unmet need occurs when assistance with daily activities is needed but not provided or inadequately provided, for ADLs or IADLs (Hass et al., 2017; LePlante, Kaye, Kang, & Harrington, 2004). The presence of unmet needs in the presence of disability in older adults may contribute to falls incidence (Sands et al., 2006), rehospitalisation (Beach et al., 2018; Hoffman et al., 2019), and other negative consequences including reduced food intake, dehydration, delirium, and pain (Grimmer, Moss, & Falco, 2004). In this study, description of unmet need was limited to the proportion of participants who did not receive assistance with ADLs, without specification of degree of functional disability. Another limitation of this study was unmet IADL needs were not described.

Another indication that participants were struggling to regain their function during their recovery (Gill et al., 2010; Krumholz, 2013), 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 (Sherrington et al., 2017).

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 (Dhalla et al., 2014; Tricco et al., 2017). 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 (Braet et al., 2016; Cheal & Clemson, 2001), and continued from the hospital to the home setting (Coleman, Parry, Chalmers, & Min, 2006; Courtney et al., 2012; Naylor et al., 1999).

This evaluation has strengths worth noting. It was conducted according to a published protocol (Naseri et al., 2018), followed a large cohort for 6 months with minimal dropout and used direct reporting from participants at baseline and follow up. 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 (Hill et al., 2019). There were some study limitations also. The risk of a false negative finding due to a smaller effect size than anticipated or a potential loss of statistical efficiency attributable to using conservative mixed effect modelling 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 non-significant 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 behaviours. Further evaluation of the intervention's effect on participant' capability, such as whether they were knowledgeable about what they needed to do to prevent falls when leaving hospital, is still

required. In particular, further qualitative evaluation that identifies what barriers and enablers participants faced during their recovery over the six-months following hospital discharge is required.

4.5.1 Conclusion

A tailored education program delivered in hospital did not significantly change older adult fall prevention behaviours during the six-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 adult health behaviour change once they return home from hospital. Further research is required to evaluate why participants did not change behaviour and explore possible barriers to their engagement in the context of their life-circumstances.

4.6 References

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CHAPTER 5 STUDY 2: Older Adult Capability and Motivation for Falls Prevention Post-Hospitalisation: Evaluation of Tailored Education

Preface

This evaluation of tailored fall prevention education was completed based on the previous evaluation (Chapter 4) that showed education alone did not adequately increase older adults' ability to engage in falls prevention after discharge compared to usual care. Health behaviour change theory proposes that tailored education needs to raise participant knowledge and motivation to enable behaviour change. This chapter reports the impact of the tailored education intervention on participant capability and motivation to engage in fall prevention strategies at six-months after discharge home from hospital. The chapter is based on a manuscript that is currently under peer review with a journal.

Naseri, C., McPhail, S.M., Morris, M.E., Haines, T.P., Etherton-Beer, C., Shorr, R., Flicker, L., Bulsara, M., Netto, J., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A-M. (2019). Older adult capability and motivation for falls prevention post-hospitalisation: evaluation of tailored education. (under peer review).

5.1 Abstract

Background: Recently hospitalized older adults have limited engagement in health behaviours that improve their post-discharge recovery. The study objective was to evaluate whether a tailored education program improved older adult capability and motivation to engage in fall prevention strategies during six-months following hospital discharge.

Methods: A process evaluation of a two-group RCT (n=390) participants (patients 60 years and over with good cognition) from three hospitals in Australia. Participants were randomized into education or control groups and continued to receive usual care. Outcomes were participant capability and motivation to engage in fall prevention strategies, based on the 'Capability Opportunity Motivation-Behaviour' framework. Data were gathered at baseline and at six months post discharge using structured surveys with likert scales and analysed using generalized linear modelling.

Results: There were n=292 (76.4%) participants who completed follow-up interviews (n=149 intervention, n=143 control). Participants who received tailored fall prevention education in hospital demonstrated significant improvements in capability [-0.4, 95%CI (-0.7, -0.2), $p<0.01$] and motivation [-0.8, 95%CI (-1.1, -0.5), $p<0.01$] compared to control when surveyed prior to hospital discharge. At six months follow-up there were no significant differences in outcomes between groups: the education group maintained improved capability and motivation, while the control group gained capability and motivation during six-months post-discharge.

Discussion and Implications: Tailored fall prevention education enabled older adults to develop capability and motivation to engage in fall prevention strategies at the time of hospital discharge, while those receiving usual care alone depended on experience and new learning to develop capability and motivation during their recovery.

5.2 Introduction

Recent evidence shows that effective fall prevention interventions for older adults in the general community do not always apply to those who have been recently hospitalized (Naseri, Haines, et al., 2018). Discharge interventions designed to prevent falls by increasing patient knowledge have been reported to facilitate hospital to home transitions (Leppin, Gionfriddo, Kessler, & et al., 2014). They are also argued to reduce hospital readmissions in older adults by reducing the rate of community falls (Gonçalves-Bradley, Lannin, Clemson, Cameron, & Shepperd, 2016; Greysen et al., 2016; Rubenstein, 2006). Previous research has also suggested that to prevent hospital readmissions, discharge interventions should ideally be provided over an extended period that includes when the patient is in hospital, through to when they go home (Braet, Weltens, & Sermeus, 2016).

Patient-directed discharge plans that include fall prevention education delivered at the time of hospital discharge have mixed evidence for post-hospitalisation adverse events such as falls (Gonçalves-Bradley et al., 2016; Leppin et al., 2014). One study showed that readmitted patients had understood and engaged in their discharge plan, yet still experienced unanticipated problems with falls, mobility and self-care (Greysen et al., 2016). Arguably, more education and support may have been warranted at discharge, to prevent subsequent falls in the community.

'Tailored education' (Kreuter, Strecher & Glassman, 1999), is a person-centred approach that considers individual knowledge and experiences (Berwick, 2009; Frosch & Elwyn, 2014). It has been recommended for improving patient capacity for self-care in transitioning from hospital to home (Coulter & Ellins, 2007; Nyman & Victor, 2012). In relation to fall prevention, the results have been mixed (Hill, Etherton-Beer, & Haines, 2013; Lee, Pritchard, McDermott & Haines, 2014). A recent randomized controlled trial (RCT) of

tailored falls education did not significantly reduce falls or improve older adult engagement in fall prevention strategies following hospital discharge (as presented in Chapter 4 and Appendix B) (Hill et al., 2019; Naseri et al., 2019). However, health behaviour change theory (Michie, van Stralen, & West, 2011), proposes that tailored education needs to raise participant knowledge and motivation to enable behaviour change. It is possible that the tailored education intervention did not sufficiently raise knowledge and motivation to enable older adults to engage in desired fall prevention strategies once they were discharged home from hospital. Therefore, it was important to conduct a parallel evaluation of the components of behaviour change to help interpret findings.

5.2.1 Objective

This study measured the level of capability and motivation for engagement in fall prevention strategies at six months after hospital discharge for participants who received the tailored education intervention in addition to usual care, compared to control conditions.

5.3 Methods

A process evaluation of a tailored falls education program that was intended to facilitate the engagement of older adults in fall prevention strategies following hospital discharge. The protocol for the evaluation (see Chapter 3) has been published elsewhere (Naseri, McPhail, et al., 2018). The 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 six-month period following hospital discharge (see Appendix B) (Hill et al., 2019).

5.3.1 Ethical considerations

Ethical approvals were obtained from human research ethics committees of the participating hospitals and universities. The participants provided written informed consent to participate in the study.

5.3.2 Participants and setting

Briefly, participants (n=390) enrolled in the RCT were patients aged 60 years and over, with good cognition (inclusion criteria > 7/10 on Abbreviated Mental Test Score (Hodkinson, 2012)), discharged to the community from three rehabilitation hospitals in Western Australia. Participants were recovering from a variety of medical, surgical and neurological conditions (Hill et al., 2019).

5.3.3 Education intervention

Details of education, control, and usual care conditions have been described elsewhere (see Chapter 3 & Appendix B) (Hill et al., 2019; Naseri, McPhail, et al., 2018). The education aimed to empower participants to be active in their discharge planning by collaborating with educators to mutually develop action plans to accept suitably tailored services, or therapy to reduce falls risks during their recovery at home following hospitalisation. Fall prevention

strategies focused on seeking assistance with daily activities following hospital discharge, an occupational therapist home assessment, and safe, appropriate exercises. The education intervention was adapted for low functional health literacy and used a DVD and workbook with identical content that depicted an older person as the patient model. It was delivered by a physiotherapist trained to tailor the education according to patients' knowledge of fall prevention strategies and potential barriers to engagement following hospital discharge.

5.3.3.1 Theoretical Framework

The Behaviour Change theory utilized during the design of the education intervention (Hill et al., 2017), incorporated the 'COM-B framework' (Michie, van Stralen, & West, 2011) (Capability, Opportunity, Motivation-Behaviour) to identify active components that would enable participants to engage in fall prevention following hospitalisation. The same framework was used during this evaluation, to determine the intervention effect on Capability and Motivation components. The COM-B framework conceptualises that each component may interact to affect behaviour (Michie, van Stralen, & West, 2011). For the purpose of this evaluation, capability and motivation components were framed as internal to participants, such as their general knowledge about falls (capability), their self-awareness of their own falls risks (motivation), and willingness to participate in fall prevention strategies (motivation). External components (opportunity) considered social and physical enablers that may have existed in participants post-hospitalisation environment.

5.3.4 Outcomes

The outcomes for the evaluation pertained to internal behavioural change components and included:

i) Capability: participant knowledge and awareness about the risks of falls, falls injuries, and reduced independence in older people following hospital discharge; and knowledge of fall prevention strategies;

ii) Motivation: participant self-perceived awareness about their own falls risks, likelihood of reduced independence following hospital discharge, and willingness to engage in fall prevention strategies.

Capability and motivation outcomes were measured for both groups by blinded research assistants using structured surveys face to face in hospital prior to allocation at baseline (T1), following the education intervention, but prior to discharge (T2), and by telephone at six months following hospital discharge (T3). The surveys were modified from previous studies that evaluated fall prevention behaviour change interventions, (Hill, Etherton-Beer, & Haines, 2013; Hill et al., 2015) and contained questions that were closed-item statements requiring responses on a five-point likert response scale, where 1('strongly agree') indicated a better outcome compared to 2 ('agree'), 3 ('undecided'), 4 ('disagree'), and 5 ('strongly disagree'). Survey questions were worded to stimulate a response that would indicate the level of capability and motivation to engage in fall prevention strategies. For example, the wording of a survey item pertaining to capability, regarding participant awareness of falls risks in older people following hospital discharge was, "I think that older people who go home from hospital are at risk of falling over in the first six months following hospital discharge".

5.3.5 Procedure

The survey was pilot tested on a representative sample of ten older people recently discharged home from hospital to confirm face, content and construct validity (Creswell, 2014). The complete survey structure is outlined in table 5.1. Questions 6-9 were asked only of the education group, and were supported by qualitative open-ended responses, however we did not ask the control groups these questions as there was a risk of unblinding and confounding with information. Questions 10-12 were asked of both groups at T1 and T2 for the purpose of treatment fidelity, in ensuing participants understood the education program. During the survey, participant responses were clarified with open ended responses, however,

for the purposes of this chapter, only the quantitative closed ended responses were reported. Following recruitment, research assistants completed baseline assessments, then participants were randomized into education or control groups and continued to receive usual care (Hill et al., 2019). Intervention group participants received education tailored according to their identified prior knowledge of fall prevention strategies, and potential barriers to engagement following hospital discharge. Educators collaborated with participants to formulate a personalized action plan prior to discharge, and also provided guided feedback once per month via telephone, for three months after hospital discharge (Hill et al., 2019).

5.3.6 Statistical Analysis

All analyses were conducted using Stata release 15.1, (StataCorp, College Station, Texas, 2017), the significance level set at 0.05, and the sample size previously determined by primary trial effect analysis (Hill et al., 2017). Intention to treat analysis was undertaken to determine influence of group allocation on outcomes based on the trial randomisation. Non-parametric likert scale outcome data were summarized using median and interquartile range (IQR) for both groups at data collection timepoints (T1, T2, T3). Graphs of the proportion of response ratings between 1 and 5 for each outcome at the three timepoints were completed to present the data. Differences in capability and motivation within and between groups, with and without the interaction of time were compared using linear modelling, with adjustment for potential covariates consistent with a prior pilot study of the trial (Hill, Etherton-Beer, & Haines, 2013).

Table 5.1 Semi-structured survey

Outcome	Question [a]	Component	Data-collection time-points [b]	Response options
Capability	1	Knowledge of older adults' risk of falls after hospital discharge	T1, T2, T3	5-point Likert scale
Capability	2	Knowledge of older adults' risk of falls injuries after hospital discharge	T1, T2	5-point Likert scale
Motivation	3	Awareness of own falls risks after hospital discharge	T1, T2, T3	5-point Likert scale
Motivation	4	Awareness of own falls injury risk after hospital discharge	T1, T2, T3	5-point Likert scale
Motivation	5	Awareness of own risk of loss of independence after hospital discharge	T1, T2, T3	5-point Likert scale
Capability	6	Knowledge of how to prevent falls after returning home from hospital	T2, T3	5-point Likert scale
Capability	7	Knowledge of how to gradually return to normal activities after returning home from hospital	T2, T3	5-point Likert scale
Motivation	8	Willingness to do the things they needed to do to avoid falls after returning home from hospital	T2, T3	5-point Likert scale
Motivation	9	Motivated to prevent falls after returning home from hospital	T2, T3	5-point Likert scale
Capability	10	Knowledge of proportion of older people that tend to fall after hospital discharge	T1, T2	Percentage
Capability	11	Knowledge of proportion of older people who tend to have reduced independence after hospital discharge	T1, T2	Percentage
Capability	12	Knowledge of proportion of older people who tend to have a serious fall injury following hospital discharge	T1, T2	Percentage

Note: **a** Questions 1-5 & 10-12 both groups surveyed, 6-9 education group only surveyed **b** Data collection timeframes: T1in hospital prior to education T2 post-education prior to discharge T3 6-months post-discharge

5.4 Results

Participant flow through the study is presented in Figure 5.1. There were 390 participants enrolled in the RCT across three hospital sites (Hill et al., 2019). At six months post-discharge, 334 (87.4%) participants remained. Of these, 38 participants had been admitted to nursing homes during the follow-up period and four participants declined to complete the survey, leaving a total of 292 (76.4%) available to complete the final survey. There were no significant differences between the remaining participants in the two groups. The characteristics of the 292 participants who completed the final survey are presented in table 5.2.

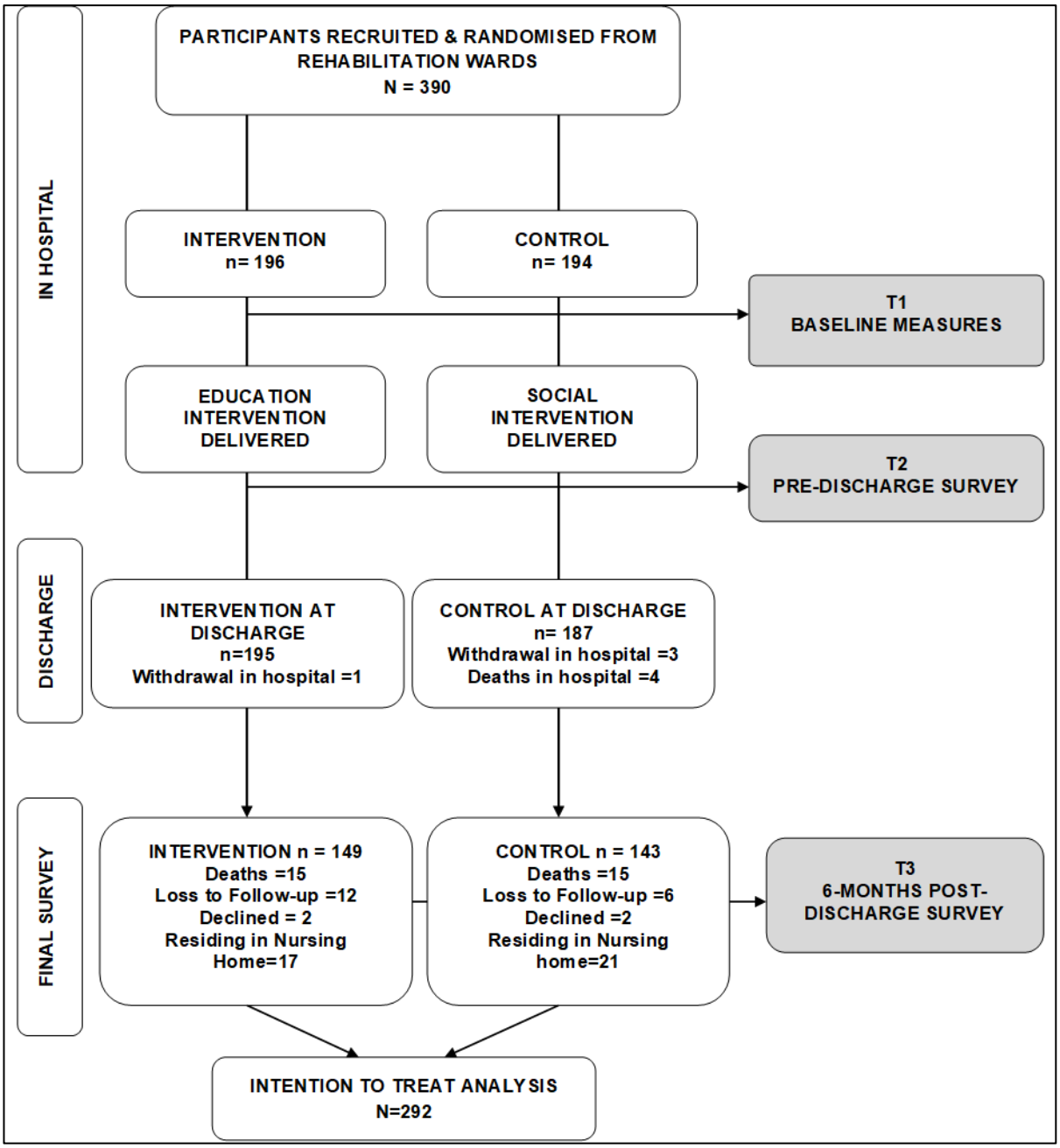

Figure 5.1 Participant flow through the study

Table 5.2 Demographic characteristics of participants

Variable [a]	Education n=149	Social Control n=143
Age, mean (SD)	77.2 (8.9)	77.9 (8.4)
Gender Female	90 (60.4)	95 (66.4)
Length of stay in hospital (days): median (IQR)	24 (43-16)	24 (35-18)
Highest education level attained		
Primary	15 (10.1)	23 (16.1)
Grade 10	68 (45.6)	62 (43.4)
Grade 12	17 (11.4)	19 (13.3)
Technical college	27 (18.1)	22 (15.4)
University	22 (14.8)	17 (11.9)
Visual impairment [b]	44 (29.5)	35 (24.5)
Hospital admission in 1 year prior to current	54 (36.2)	67 (46.8)
Fell in 6 months prior to hospital admission	107 (71.8)	99 (69.2)
Fell in hospital prior to discharge	12 (8.0)	12 (8.4)
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 [c]	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)
Depressed mood, GDS <5[d]	0.2 (0.4)	0.24 (0.4)
AQoL[e] mean (SD)	0.6 (0.1)	0.6(0.1)
ADL Function at discharge		
Katz[f] median (IQR)	5 (6-3)	5 (6-3)
Lawton's [g] median (IRQ)	7 (8-5)	7 (8-6)

Note: **a** all data measured in n(%) unless otherwise stated **b** glaucoma, cataracts, macular degeneration **c** Transitional Care or Nursing Home **d** Geriatric Depression Scale Short Form, score ≥ 5 suggests depression **e** AQoL-6D utility instrument **f** Katz Index of Independence in Activities of Daily Living, range 0-6 greater score indicates more independence **g** Lawton's Instrumental Activities of Daily Living, range 0-8 greater score indicates more independence

5.4.1 Participant levels of capability and motivation

Figure 5.2 presents participant levels of capability and motivation in both intervention (education) and control groups. These were measured at baseline (T1), in hospital prior to discharge (T2) and at six months post-discharge (T3). Table 5.3 presents summarized descriptive statistics (median and interquartile range), and 5.4 presents complete data (number and percentage) of the levels of capability and motivation for both groups at baseline (T1), at follow-up prior to discharge (T2), and six-months post-discharge (T3).

Table 5.3. Capability and motivation at three timepoints for intervention and control groups

Outcome: Item[a]	**Education Group** Median (IQR)			**Control Group** Median (IQR)		
	T1[b] n=195	T2 n=189	T3 n=149	T1 n=187	T2 n=182	T3 n=143
Capability						
1. Knowledge of other older peoples' post-discharge falls risk	2 (2-3)	2 (1-2)	2 (1-2)	2 (2-3)	2 (1-2)	2 (1-2)
2. Knowledge of other older people's falls-injury risks following hospital discharge[c]	2(1-2)	2(1-2)		2(1.5-2)	2(2-2)	
Motivation						
3. Awareness of own post-discharge falls risks	3 (2-4)	2 (1-2)	4 (2-5)	3 (2-4)	3 (2-4)	4 (2-5)
4. Awareness of own post-discharge falls-injury risks	2 (2-4)	2 (1-2)	2 (2-3)	2 (2-3)	2 (2-3)	2 (2-2)
5. Awareness of own post-discharge loss of independence risks	2 (2-4)	2 (1-2)	1 (1-1)	2 (2-4)	2 (1-2)	1 (1-2)

Notes: **a** item is capability or motivation outcomes measured using median (IQR) of likert scale responses where 1=strongly agree is a better outcome than 2=agree 3=unsure 4=disagree 5=strongly disagree **b** Data collection timeframes: T1in hospital prior to education T2 post-education pre-discharge T3 is 6months post-discharge **c** this item was omitted in the final survey

Table 5.4. Capability and motivation: complete likert scale responses for intervention and control groups at baseline and follow-up times

Outcome: **Item**[a]		**Education Group** Number (%) Response[b] (n=195 T1; n=189 T2; n=149 T3) SA	A	U	D	SD	**Control Group** Number (%) Response (n=187 T1; n=182 T2; n=143 T3) SA[c]	A	U	D	SD
Capability:											
1. Awareness of other older peoples' post-discharge falls risk	T1	34(17.4)	99(50.8)	23(11.8)	31(15.9)	8(4.1)	21(11.2)	109(58.3)	18(9.6)	33(17.7)	6(3.2)
	T2	84(44.4)	102(53.9)	3(1.7)	0	0	38(20.9)	111(60.9)	19(10.4)	11(6.0)	3(1.8)
	T3	74(49.6)	54(36.2)	12(8.0)	8(5.4)	1(0.8)	69(48.2)	55(38.5)	5(3.5)	11(7.7)	3(2.1)
2. Awareness of other older peoples' post-discharge falls - injury risk	T1	49(25.1)	124(63.5)	7(3.6)	10(5.1)	5(2.7)	46(24.6)	122(65.2)	11(5.9)	8(4.3)	0
	T2	74(39.1)	108(57.1)	5(2.6)	2(1.2)	0	40(21.9)	124(68.1)	5(2.7)	10(5.5)	3(1.8)
	T3[c]	No data					No data				
Motivation:											
3. Self-awareness of own post-discharge falls risks	T1	15(7.7)	73(37.4)	26(13.3)	60(30.7)	21(10.9)	8(4.3)	80(42.8)	10(5.3)	74(39.6)	15(8.0)
	T2	52(27.5)	107(56.6)	17(8.9)	12(6.3)	1(0.7)	20(10.9)	70(38.5)	20(10.9)	62(34.0)	10(5.7)
	T3	5(3.4)	41(27.5)	5(3.4)	56(37.6)	42(28.1)	6(4.2)	34(23.8)	3(2.1)	56(39.2)	44(30.7)
4. Self-awareness of own post-discharge falls-injury risks	T1	25(12.8)	97(49.7)	15(7.7)	48(24.6)	10(5.2)	28(14.9)	97(51.9)	17(9.1)	42(22.4)	3(1.7)
	T2	53(28.0)	118(62.4)	7(3.7)	11(5.9)	0	20(10.9)	101(55.5)	21(11.5)	36(19.8)	4(2.3)
	T3	22(14.8)	84(56.4)	15(10.1)	22(14.7)	6(4.0)	32(22.4)	80(55.9)	11(7.7)	15(10.5)	5(3.5)
5. Self-aware of own post-discharge loss of independence risks	T1	26(13.3)	99(50.8)	11(5.6)	45(23.1)	14(7.2)	22(11.7)	100(53.5)	6(3.2)	50(26.7)	9(4.9)
	T2	109(57.7)	70(37.0)	9(4.8)	1(0.5)	0	26(14.3)	98(53.8)	9(4.9)	43(23.6)	6(3.4)
	T3[c]	100(77.5)	26(20.2)	2(1.5)	1(0.8)	0	96(72.2)	30(22.6)	5(3.8)	1(0.7)	1(0.7)

Notes: **a** item is capability or motivation outcomes measured using number (%) of Likert Scale responses where 1=strongly agree is a better outcome than 2=agree 3=unsure 4=disagree 5=strongly disagree **b** Data collection timeframes: T1in hospital prior to education T2 post-education at discharge T3 is 6months post-discharge **c** At T3 30 participants (n=18 intervention, n=12 control) declined to complete survey item 5 due to individual time limitations

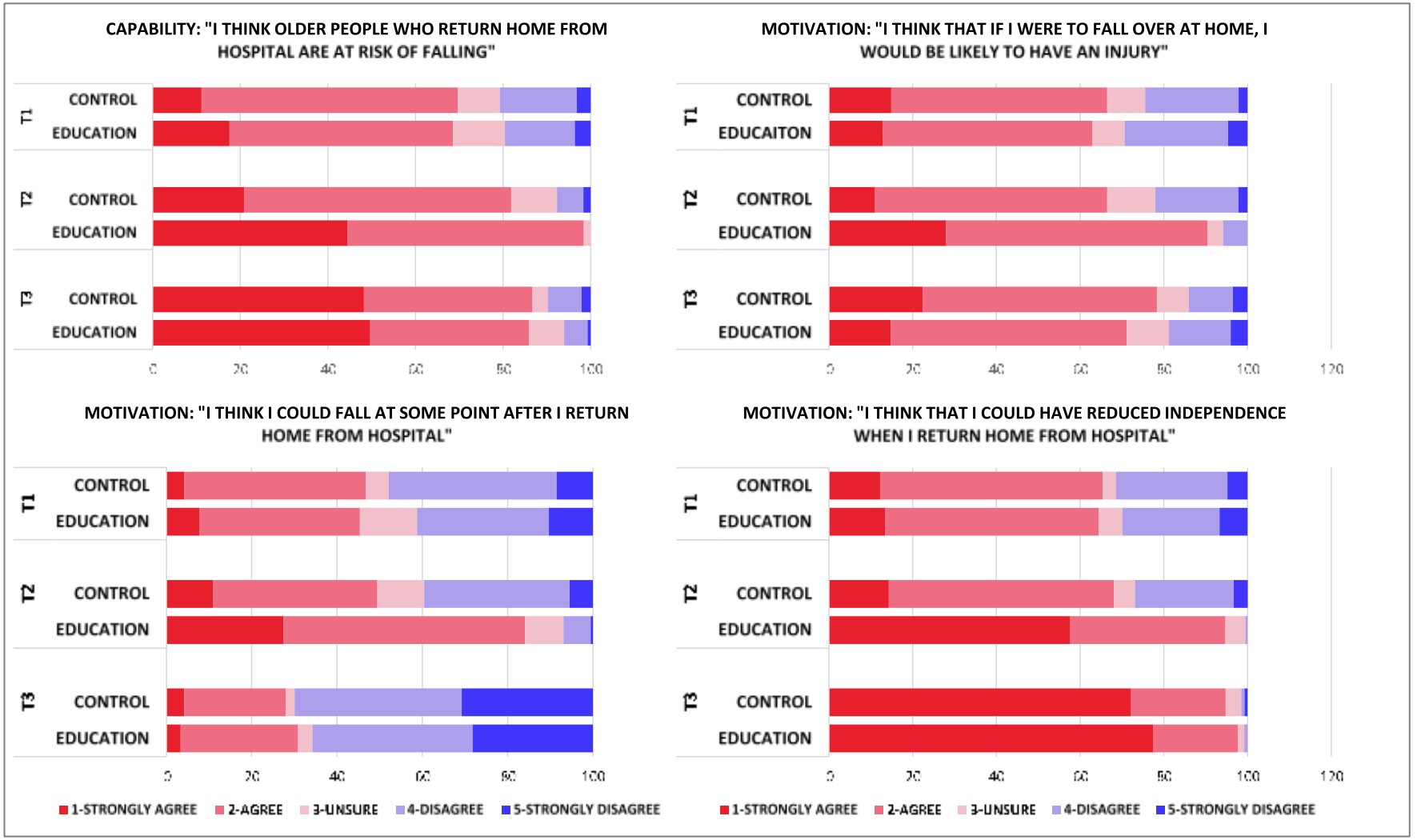

Figure 5.2 Change in levels of capability and motivation compared between intervention and control groups at three timepoints

5.4.2 Differences in capability and motivation between intervention and control groups

Table 5.5 presents changes in capability and motivation in the education (intervention) group compared to control at baseline in hospital (T1), follow-up prior to hospital discharge (T2), and six-months post-discharge (T3). Participants who received the tailored education demonstrated significant improvements in their capability (knowledge about other people's fall risks) and motivation (awareness of their own falls risks and loss of independence) compared to the control group when surveyed prior to hospital discharge (T2). When surveyed at six months after discharge (T3), the education group sustained their capability and motivation, while control group had gained capability (knowledge) and motivation (awareness of their loss of independence) with time since discharge, leading to no significant differences between groups at six-months (T3).

5.4.3 Differences in capability and motivation within intervention and control groups

Table 5.6 presents changes in capability and motivation within each group at baseline in hospital (T1), at follow-up prior to hospital discharge (T2), and at six-months post-discharge (T3). The participants who received tailored education, and those in control group demonstrated significant improvements in their capability (knowledge of other older people's risk of falls) when surveyed prior to discharge (T2), compared to baseline (T1). However, the degree of improvement in capability was higher for those who received the tailored education (intervention group response of 'strongly agree' / 'agree' improved by 30.1%, control improved by 12.3%), and this was sustained at six-months (T3) (Figure 5.2.1).

Participants who received the tailored education demonstrated significantly raised motivation (awareness of their risk of losing independence following hospitalisation) at discharge (T2) compared to baseline (T1) and maintained this motivation when surveyed at six-months (T3). Participants in the control group initially had low levels of motivation (awareness of their risk of losing independence) when surveyed prior to hospital discharge (T2), however, by six-month follow-up (T3) this motivation (awareness) was higher (Figure 5.2.4).

Table 5.5. **Changes in capability and motivation compared between intervention and control groups over time**

Item[a] (Outcome)	Independent Variables	Reference Variable	Coefficient of change[c]	95% CI	p-value
Capability					
1. Knowledge of other older people's falls risks following hospital discharge	Intervention (overall)	Control (overall)	-0.2	-0.3, -0.1	<0.01*
	Intervention at T2 [d]	Control at T2	-0.4	-0.7, -0.2	<0.01*
	Intervention at T3	Control at T3	0.001	-0.2, 0.2	0.9
2. Knowledge of other older people's falls-injury risks following hospital discharge [e]	Intervention	Control	-0.1	-0.2, -0.01	<0.01*
	Intervention at T2	Control at T2	-0.4	-0.5, -0.2	<0.01*
	Intervention at T3	Control at T3	No data		
Motivation:					
3. Awareness of own falls risks following hospital discharge	Intervention	Control	-0.4	-0.5, -0.2	<0.01*
	Intervention at T2	Control at T2	-0.8	-1.1, -0.5	<0.01*
	Intervention atT3	Control at T3	-0.01	-0.3, 0.3	0.9
4. Awareness of own risk of falls-injury following hospital discharge	Intervention	Control	-0.1	-0.2, 0.02	0.1
	Intervention at T2	Control at T2	-0.7	-0.9, -0.5	<0.01*
	Intervention at T3	Control at T3	0.05	-0.2, 0.3	0.7
5. Awareness of own reduced independence following hospital discharge	Intervention	Control	-0.4	-0.5, -0.2	<0.01*
	Intervention at T2	Control at T2	-1.0	-1.2, -0.7	<0.01*
	Intervention at T3	Control at T3	-0.1	-0.4, 0.2	0.4

Note **a** item is capability or motivation outcome **b** data collection time-variable T1baseline in hospital prior to education T2 post-education prior to discharge T3 is 6 months post-discharge **c** The coefficient of change: degree of change in outcome where a more negative coefficient indicates a stronger agreement (towards 1) on the likert scale **d** interaction with time variable*significant p-value **e** this item was omitted in the final survey

Table 5.6 Changes in capability and motivation compared within the intervention and control group over time

Item[a] (Outcome)	Group	Independent Variable[b]	Reference Variable	Coefficient of change[c]	95% CI		p-value
Capability:							
1. Knowledge of other older people's falls risks following hospital discharge	Intervention	T2	T1	-0.8	-0.9	-0.6	<0.01*
		T3	T1	-0.6	-0.8	-0.4	<0.01*
	Control	T2	T1	-0.3	-0.5	-0.2	<0.01*
		T3	T1	-0.6	-0.8	-0.5	<0.01*
2. Knowledge of other older people's falls-injury risks following hospital discharge[d]	Intervention	T2	T1	-0.3	-0.4	-0.1	<0.01*
		T3	T1	No data			
	Control	T2	T1	0.07	-0.05	0.2	0.2
		T3	T1	No data			
Motivation:							
3. Awareness of own falls risks following hospital discharge	Intervention	T2	T1	-1.0	-1.2	-0.8	<0.01*
		T3	T1	0.6	0.3	0.8	<0.01*
	Control	T2	T1	-0.2	-0.4	-0.00	0.04*
		T3	T1	0.6	0.4	0.8	<0.01*
4. Awareness of own risk of falls-injury following hospital discharge	Intervention	T2	T1	-0.7	-0.9	-0.5	<0.01*
		T3	T1	-0.2	-0.4	-0.01	0.04*
	Control	T2	T1	0.02	-0.2	0.2	0.8
		T3	T1	-0.3	-0.5	-0.07	<0.01*
5. Awareness of own reduced independence following hospital discharge	Intervention	T2	T1	-1.1	-1.2	-0.9	<0.01*
		T3	T1	-1.3	-1.5	-1.1	<0.01*
	Control	T2	T1	-0.1	-0.3	0.08	0.2
		T3	T1	-1.2	-1.4	-1.0	<0.01*

Note **a** item is capability or motivation outcome **b** data collection time-variable T1in hospital prior to education T2 post-education at discharge T3 is 6months post-discharge **c** The coefficient of change demonstrates the strength of capability and motivation outcomes, with a more negative coefficient indicating a stronger agreement (improvement) on the likert scale **d** At T3 30 participants (n=18 intervention, n=12 control) declined to complete survey item 2 and 5 due to individual time limitations *significant p-value

5.5 Discussion

Tailored fall prevention education in hospital aims to prepare patients for a gradual and safe transition home following discharge (Horwitz et al.,2013; Kang, Gillespie, Tobiano & Chaboyer, 2018). It also aims to optimize their capability and motivation to engage in fall prevention strategies once home (Hill, Hoffmann, McPhail, Beer, Hill, Brauer, et al., 2011; Hill et al., 2019). The key finding of this evaluation was that tailored education delivered in hospital prior to hospital discharge improved older adults' capability and motivation to engage in fall prevention strategies at the time of hospital discharge, and the benefits persisted for six months post-discharge. However, this positive change did not translate to increases in engagement, and falls were not reduced (Hill et al., 2019; Naseri et al., 2019).

People who received tailored fall prevention education showed significantly raised levels of motivation to engage in fall prevention at the time of hospital discharge compared to control group. This included raised awareness of their own post-discharge falls risks and likelihood of falls injury. This was encouraging given that older adults frequently do not acknowledge their own falls risks (Lee, McDermott, Hoffmann, & Haines, 2013; Mihaljcic, Haines, Ponsford, & Stolwyk, 2017). Prior studies have shown that older adults are particularly reluctant to engage in fall prevention strategies when they believe they are not at risk of falls (Haines, Day, Hill, Clemson, & Finch, 2014; Hill, Hoffmann, McPhail, Beer, Hill, Brauer, et al., 2011).

The tailored education provided in the trial also significantly raised participants' capability to engage in fall prevention at hospital discharge and their knowledge of falls risks was sustained at six-month follow-up. The education intervention enabled participants to be more prepared to engage in fall prevention strategies at hospital discharge and earlier in their recovery. In contrast, participants in the control group developed capability later in their recovery. This suggests that control group participants were more reliant upon their previous

health knowledge and experience to develop new knowledge (Beier & Ackerman, 2005). This could mean they were vulnerable to adverse events such as falls when at home (Cheal & Clemson, 2001; Hoffman et al., 2019).

Participant motivation to engage in fall prevention behaviour through their awareness of losing independence following hospital discharge was raised over time in both groups. Previous studies have reported that unmet ADL needs are common at hospital discharge (Coleman et al., 2006; Covinsky et al., 2011; Greysen et al., 2014). In order to improve health outcomes when returning home from hospital, older patients require practical assistance to manage their daily activities and regain their independence (Coleman et al., 2004; Grimmer, Moss, & Falco, 2004; Holroyd-Leduc et al., 2016). Previous evidence has found older patients may prematurely recommence their usual daily activities following hospital discharge, leading to further functional decline, loss of confidence, and falls (Forster et al., 2003; Gill, Allore, Gahbauer, & Murphy, 2010; Hass, DePalma, Craig, Xu, & Sands, 2017). This appeared to be supported by our findings that even though we improved readiness, it was not enough to change engagement once participants returned home, further suggesting that more support may be required.

5.5.1 Strengths and limitations

The current evaluation was conducted according to a published protocol and accompanied an RCT (Hill et al., 2019), that delivered an evidenced-based tailored education intervention with minimal drop-out. The education intervention was warranted based on previous evidence that recently hospitalized older adults have reduced knowledge of effective fall prevention strategies (Hill, Hoffmann, Beer, et al., 2011), have limited discussions with health professionals regarding evidenced-based fall prevention strategies (Lee et al., 2013), are reluctant to acknowledge their falls risks (Lee et al., 2015), and believe they are already doing enough to prevent falls (Haines et al., 2014). Actively engaging older adults and their caregivers in decisions relating to their health care once they return home from hospital is

important for enhancing safety through self-management, to improve quality of care and health outcomes (Coulter & Ellins, 2007).

Most discharge evaluations have a limited follow-up period of 30 to 90 days (Coleman et al., 2004; Forster et al., 2003; Greysen et al., 2014) whereas this evaluation explored the longer-term impact of the tailored education on older adults' capability and motivation for fall prevention behaviour following hospitalisation. This evaluation revealed complexities to enabling behavioural change in older adults who were recently hospitalized. Although the tailored education significantly improved motivation and capability components at the time of discharge, participants did not significantly increase their engagement in fall prevention strategies in the context of their life-experiences during their recovery post-discharge (Naseri et al., 2019). The COM-B model explains that capability, motivation and opportunity components need to be present to enable behaviour change (Michie, van Stralen, & West, 2011). Gaps between individual capacity for change (capability and motivation) and external life-demands (opportunity) have been referred to as "missing pieces" (Greysen et al., 2014), in discharge plans (Covinsky et al., 2011; Grimmer, Moss, & Falco, 2004). Although some external (social and environmental) demands were considered prior to hospital discharge, at the time the tailored education program was provided, some were not foreseeable to educators or patients and therefore could not be controlled during the RCT. Educators prepared patients to engage with available supports delivered through hospital and community organizations, however the intervention did not deliver direct support in the home and community. A limitation of this process evaluation was that participant experiences of external demands that were faced when they returned home from hospital, such as the availability and timing of community support services, were not investigated during this phase of the process evaluation. Future qualitative research is planned to explore participants' experiences to understand how these external demands might have impacted on behaviour change (Naseri, McPhail et al., 2018).

For the purpose of this evaluation, it was important to present the quantitative results of both groups over the three time-periods. There were questions (see questions 6-9 Appendix F) asked of the education group that were accompanied with open ended questions to enable clarification of the effect of the education program for treatment fidelity. These questions were not asked of participants in the control group due to a risk of unblinding and confounding of results. Questions 10-12 were asked of both groups at T1 and T2 also for the purpose of treatment fidelity and ensuring participants understood the education program.

5.5.2 Conclusion

This evaluation of a behavioural change intervention highlights the challenges involved in educating hospitalized older adults to prevent falls after hospital discharge. The tailored fall prevention education enabled older adults to develop capability and motivation to engage in fall prevention strategies earlier in their recovery at the time of hospital discharge. In contrast those receiving usual care alone depended on experience and new learning to develop capability and motivation over the six-month recovery period. Even though intervention group participants were motivated and acquired the capacity to prevent falls through the education program, they did not engage in significantly more strategies than the control group. The differences between participants' capacity and motivation for fall prevention engagement, and the opportunity (barriers and enablers to fall prevention) that existed within their life situations once they returned home, warranted a qualitative exploration.

5.6 References

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CHAPTER 6 STUDY 3: Perspectives of Older Adults Regarding Barriers and Enablers to Engagement in Fall Prevention Activities Following Hospital Discharge

Preface

This chapter explores the impact of the tailored education intervention from participants' perspectives regarding the barriers and enablers to their engagement in fall prevention strategies during six-months after hospital discharge. Using a qualitative exploratory approach with interpretative phenomenological analysis, this study provides credible, real-world older adult perspectives, generalisable to high-risk populations recently hospitalised. The gaps revealed in skills and opportunities for older adults to engage in fall prevention activities after hospital discharge are a valuable guide for healthcare services, to support their unmet needs and the development of integrated care services between healthcare professionals and caregivers. The chapter is based on a manuscript that is currently under peer review with a journal.

Naseri, C., McPhail, S.M., Haines, T.P., Morris, M.E., Shorr, R., Etherton-Beer, C., Netto, J., Flicker, L., Bulsara, M., Lee, D-C.A., Francis-Coad, J., Waldron, N., Boudville, A., Hill, A-M. (2019). Perspectives of older adults on barriers and enablers to engagement in fall prevention activities following hospital. (under peer review)

6.1 Abstract

Background: Older adults recently discharged from hospital are at high risk of functional decline and falls. Tailored fall prevention education provided at hospital discharge aims to improve the capacity of older adults to engage in falls prevention activities. What remains unknown are the factors that affect behaviour change after hospital discharge.

Methods: This study identified the perceived barriers and enablers of older adults to engagement in fall prevention activities during the six-month period post discharge. An exploratory approach using interpretative phenomenological analysis focused on the lived experience of a purposive sample (n=30) of participants. All were recruited as a part of an RCT (n=390) that delivered a tailored fall prevention education program at three hospital rehabilitation wards in Perth, Australia. Data were collected at six-month post discharge using semi-structured telephone surveys.

Results: Personal stories confirmed that some older adults have difficulty recovering functional ability after hospital discharge. Reduced physical capability, such as experiences of fatigue, chronic pain, and feeling unsteady when walking were barriers for participants to safely return to their normal daily activities. Participants who received the tailored fall education program reported positive effects on knowledge and motivation to engage in fall prevention. Participants who had opportunities to access therapy or social supports described more positive experiences of recovery compared to individuals who persevered without assistance. A lack of physical and social support was associated with apprehension and fear toward adverse events such as falls, injuries, and hospital readmission.

Discussion and Implications: The lived experience of participants following hospital discharge strongly suggested that they required more supports from both healthcare professionals and caregivers to ensure their needs were met.

6.2 Introduction

Older adults who have recently been discharged from hospital are a group at high-risk for falls injury (Hill, Hoffmann, McPhail, Beer, Hill, Oliver, et al., 2011; Hoffman et al., 2019). They are also at risk of hospital readmission (Greysen et al., 2016; Jencks, Williams, & Coleman, 2009) and fall-related death (Burns & Kakara, 2018). Heightened risks appear to reflect the discharge care provided, as well as the characteristics of older patients who can have diminished function (Boyd et al., 2008; Covinsky, Pierluissi, & Johnston, 2011), and sustained disability after hospital discharge (Gill, Allore, Gahbauer, & Murphy, 2010; Krumholz, 2013).

Previous observational studies reported that older adults who transition from hospital to home have limited falls prevention knowledge (Hill, Hoffmann, McPhail, Beer, Hill, Oliver, et al., 2011). They are often poorly prepared to manage their physical limitations, despite increased risk of falls during this period (Kripalani, Jackson, Schnipper, & Coleman, 2007). Tailoring fall prevention interventions requires the consideration of individual knowledge, circumstances and preferences for addressing falls risks (Kreuter, Strecher, & Glassman, 1999). This individualized approach has been recommended for improving engagement of older adults in preventing their own falls (Hill, Etherton-Beer, & Haines, 2013; Nyman & Victor, 2012). It also promotes self-management, (Horwitz, 2016) and the transition from hospital to home (Grimmer, Moss, & Falco, 2004; Weiss et al., 2019).

A recent RCT that evaluated a tailored fall prevention education program delivered by trained physiotherapists at hospital discharge (Hill et al., 2019), showed no significant effects in reducing falls or fall injuries after discharge. The overall fall rate was 5.9 per 1000 patient days and the injurious fall rate was high in both groups (2.9 per 1,000 patient-days) indicating an ongoing high risk of adverse events after hospitalisation (see Appendix B).

Furthermore, the education did not translate to a significant increase in levels of participant engagement in fall prevention activities compared to the control condition (Naseri et al, 2019).

Following that trial, Study 2 (chapter 5) found that the tailored falls prevention intervention improved the capacity and motivation of older adults to undertake fall prevention activities at the time of hospital discharge. It also showed the benefits to persist for up to 6 months after discharge. However, this did not translate to a significant increase in levels of participant engagement in fall prevention activities compared to the control condition (Naseri et al, 2019). Health behaviour change theory suggests that as well as capability and motivation, individuals require opportunities to change their behaviour (Michie, van Stralen, & West, 2011). To explore the post-hospitalisation effect of the tailored education intervention, it was important to also seek to understand how social and physical opportunities within the life-circumstances of older patients influenced their fall prevention behaviours once they returned home.

The purpose of the current study was to explore perspectives of older adults regarding the barriers and enablers to engagement in fall prevention activities within six months after hospital discharge.

6.3 Methods

6.3.1 Ethical considerations

Ethical approval was obtained from human research ethics committees of the participating hospitals and universities. All participants provided written informed consent.

6.3.2 Design

The study took an exploratory approach using Interpretative Phenomenological Analysis (IPA) (Smith, Flowers, & Larkin, 2009). The focus was on the lived experience of participants in undertaking fall prevention activities after hospital discharge, and the meaning of this experience for them. The 'double hermeneutic' phenomenological approach involved the researcher getting as close as possible to the personal lived experience of participants in the post-hospitalisation period, by hearing and interpreting the details through an 'iterative and inductive cycle' (Smith, Flowers, & Larkin, 2009).

6.3.3 Participants and setting

Purposive sampling of participants (n=390) who were enrolled in the RCT (Hill et al., 2019) was undertaken. Briefly, these participants were patients aged 60 years and over, recovering from a variety of conditions, with good levels of cognition (inclusion criteria > 7/10 on Abbreviated Mental Test Score (Hodkinson, 2012), discharged to the community from three rehabilitation hospitals in Western Australia. Sampling was stratified with consideration of group allocation, age, gender, fall history, and willingness to participate in an in-depth telephone interview. Theoretical saturation was confirmed through consensus of a second researcher reviewing the transcribed data and primary researcher notes.

6.3.4 Data collection and procedure

Data were collected using a semi-structured phone survey with questions based on the COM-B framework (Michie, van Stralen, & West, 2011). An individual phone interview was selected rather than a focus group, or face to face interview, as participants had previously received monthly phone monitoring as a part of the RCT, so the researcher had established a genuine rapport with participants. Questions were framed around the experience's participants reported regarding barriers and enablers to participant engagement in fall prevention activities using comments and open responses (see Appendix G). The semi-structured survey contained open-ended, non-directive questions and was piloted to explicitly consider the topics, to remove potential blind spots, bias, and sensitive questions. Each interview was recorded and transcribed verbatim to gain true participant reflections, adding credibility to the results (Liamputtong, 2013). The rapport generated over the six-month follow-up assisted the researcher to glean a more holistic understanding of the social world of the older adult following hospital discharge, and thus acted as a powerful tool to conduct IPA (Noon, 2018). The issue of researcher positionality and bracketing was relevant to IPA methodology (Moriah, 2018). The primary researcher (CN) who was conducting this study as a part of PhD studies was a female physiotherapist with 20 years of clinical gerontological experience. Although the researcher followed recommendations in bracketing her own pre-existing theoretical understanding during data-collection and analysis (Smith, Flower and Larkin, 2009), researcher experience and preconceptions were helpful to understanding the lived experience of participants (Moriah, 2018). A journal and audit trail recorded researcher observations and reflections regarding participants' language and portrayed emotions during the in-depth interview, as well as during the monthly falls data collection phone survey, to aid understanding and interpretation of the participants' accounts over the six-month time period (Smith, Flower and Larkin, 2009).

6.3.5 Theoretical framework

The tailored education intervention delivered in the RCT, which has been described in detail previously (see Chapter 3 & Appendix B) (Hill et al., 2019; Naseri et al., 2018), was a complex intervention based on the COM-B model of health behaviour change (Michie, van Stralen, & West, 2011). The model recognises that individual behaviour change is supported through a combination of capability (physical and psychological), opportunity (provided within their social and physical environment), and motivation. The education intervention aimed to facilitate participant engagement in fall prevention activities after hospital discharge. It provided participants with knowledge (capability) and meaning (motivation) relevant to their individual circumstances (opportunity) (Hill et al., 2019). The education was delivered by trained, experienced physiotherapists using a workbook, video and individualised goal setting. Action planning focused on preparing participants for their imminent discharge from hospital and included fall prevention activities such as completion of safe exercise, modification of home hazards, and seeking assistance with daily activities to facilitate a gradual return of function. The use of the Theoretical Domains Framework (TDF) that was linked to the COM-B framework (Cane, O'Connor, & Michie, 2012; Francis, O'Connor, & Curran, 2012), helped to account for the wide range of emergent barriers and enablers that affected participants' fall prevention engagement in the context of their life-circumstances after hospital discharge.

6.3.6 Analysis

The analysis was directed towards identification of barriers and enablers to participants undertaking fall prevention activities such as completion of safe exercise, modification of home hazards, and seeking assistance with daily activities to facilitate a gradual return of function following hospital discharge (Hill et al., 2019; Naseri et al., 2018). The interpretative analysis occurred on many levels, with each analysis becoming more interpretative based on reading from within the text itself (Smith, Flower and Larkin, 2009).

Initially the primary researcher took both an empathetic and enquiring stance to understand participant perspectives about undertaking fall prevention activities following hospital discharge, by 'reading and re-reading' the detailed transcripts, and considering the language (tone, repetition, fluency, emotion) used by the participant (Smith, Flowers, & Larkin, 2009). 'Initial noting' occurred to convert text into units of meaning, capturing and bracketing first impressions (Smith, Flowers, & Larkin, 2009). During the second phase of interpretation, qualitative data were coded for emergent themes capturing participants' barriers and enablers to engagement in fall prevention activities, examined for recurrence, then triangulated with blinded researcher observations noted during monthly phone data collection as a part of the RCT (Hill et al., 2019). These notes were used during the third phase of analysis to provide detailed reading of the temporal construction of participant accounts that helped to characterise and understand periods of vulnerability embedded within their six-month recovery after hospital discharge. 'Super-ordinate themes' were developed out of an 'abstraction process' (Smith, Flowers, & Larkin, 2009), where patterns between emergent themes were identified then linked to capability, opportunity, and motivation components (COM-B model) as sources of behaviour change (Atkins et al., 2017). The final process of analysis was bringing it altogether into a table showing the structure of the super-ordinate themes (COM-B), emergent themes at the group level (TDF), and quotes taken from transcribed interviews to represent individual level data (Smith, Flowers, & Larkin, 2009).

To ensure credibility, emergent themes and super-ordinate themes were discussed and compared between two researchers (Creswell, 2000). The second researcher (AMH) was also an experienced physiotherapist researcher who worked with older post discharge populations conducting qualitative studies regarding falls experiences. Themes were then considered for their importance according to 'saliency analysis' (Buetow, 2010), that is the degree to which each theme recurred, or was of importance to participants or researchers, or both. Themes of high importance were those that progressed the understanding of real-world situations affecting participant engagement in fall prevention activities. A final overall framework

assisted to conceptualise how participant fall prevention behaviour was impacted by the presence or absence of barriers and enablers, categorised as important themes within the COM-B components (Michie, van Stralen, & West, 2011).

6.4 Results

The semi-structured phone interviews were conducted over a 16-month period (December 2016-April 2018), with a duration of 30-100 minutes. There were 292 participants who completed the final quantitative survey as a part of the trial. At that point 43 (14.72%) participants were excluded due to a current medical illness and 4 declined to take part in a further survey. Of the remaining, 245 (84%) participants, we purposively approached n=30 participants (12%) to complete the final in-depth interview. Consideration in the sampling was given to participants who had offered rich insights into their post discharge experiences during prior monthly telephone surveys. The characteristics of the sample are presented in Table 6.1. In consideration of the larger sample size, the emphasis subsequently turned to assessing key emergent themes for the whole group, with reference to individual 'real-self' level data as illustrations (Smith, Flower and Larkin, 2009). This produced the structure of the super-ordinate themes (COM-B), emergent themes at the group level (TDF), and quotes taken from transcribed interviews to represent individual 'real-self' level data (Smith, Flower and Larkin, 2009). Thematic data saturation was reached after detailed analysis of text taken from 30 participants, with consideration of group allocation, gender, age, and post-discharge incidence of falls. The structure of the super-ordinate themes (COM-B), emergent themes at the group level (TDF), and quotes taken from transcribed interviews representing individual level data are presented in Figure 6.1.

Table 6.1. Characteristics of participants

Variable	Sample (N=30)
Received intervention, n (%)	13 (43.3)
Age, Mean (SD)	78.7 (9.3)
Gender, female, n (%)	17 (56.67)
Highest education level attained, n (%)	
Primary	2 (6.7)
Grade 10	12 (40)
Grade 12	6 (20)
Technical college	6 (20)
University	4 (13.3)
Hospital admission in 1 year prior to current admission n (%)	11 (36.7)
History of falls in 12 months prior to current hospital admission n (%)	19 (63.3)
Falls within 6 months after hospital discharge n (%)	15 (50)
Discharge Destination n (%)	
Home alone	14 (43.3)
Home with partner	14 (46.7)
Home with other	2 (6.7)
Discharge mobility n (%)	
No aid	3 (10)
Walking stick	4 (13.3)
Walking frame	21
Wheelchair or requires assistance	2 (6.7)

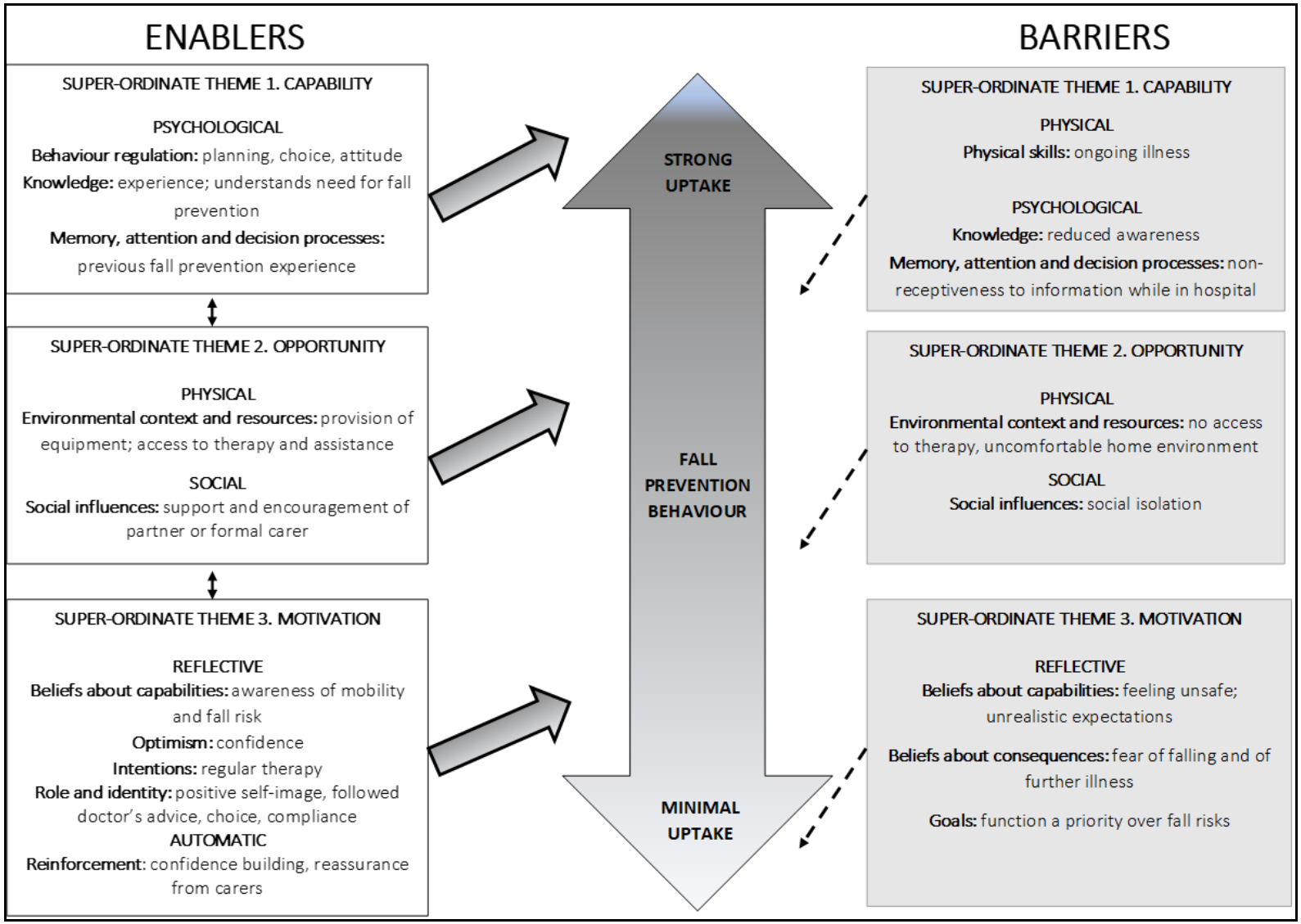

Figure 6.1 Final framework of impact of barriers and enablers on engagement in fall prevention activities

6.4.1 Super-Ordinate Theme 1. Capability to engage in fall prevention activities

Participants' perceived physical capability and their knowledge and understanding of how to manage their falls risks were found to strongly influence participant decision-making toward fall prevention behaviours. An overview of this superordinate theme alongside exemplar quotes are presented in Table 6.2.

6.4.1.1 Capability as an enabler to fall prevention behaviour

Participants who demonstrated knowledge (psychological capability) of the problem of falls following hospital discharge, such as awareness of the prevalence, expressed an intention to engage in fall prevention activities, "…it was the fact that people are more likely to fall again after having a fall, I didn't want to be one of those people who would fall again" (#23, intervention, female). Some participants displayed knowledge of why fall prevention was important, as well as how to enact their prepared fall prevention action plan, "you've got to slow down a bit, don't push it too hard, and give your body a chance to catch-up" (#387, intervention group, female).

Physical capability as an enabler was demonstrated by participants who had the physical skills and stamina to complete fall prevention activities, "I have always been an exercise person, I do leg lifts even when I'm resting in the chair, and try to move as much as I can" (#367, intervention, female).

Table 6.2. Capability barriers and enablers to fall prevention behaviour

SUPER-ORDINATE THEMES /TDF	Barrier or Enabler	Emergent theme	Exemplar quote
Psychological Capability			
/Knowledge	Barrier	No action plan	"I've always been self-reliant and don't expect other people to look after me and I wanted to get back home and just carry on as usual… I wouldn't know where to get help, I just managed" #294, control group, female.
	Enabler	Antecedents: falls experience	"I was very wary that I didn't want to fall again" #99, control group, female.
/Memory, Attention and /Decision Processes	Barrier	Graded information/tasks	"I think I may have listened a little bit more after I was home, but I think I still would have had a lot of trouble understanding." #313, control group, male
	Enabler	Health consequences knowledge (avoiding hospital readmission)	"I was determined not to go down that road again if it would help" #346, control group, non-faller, female
/Behaviour Regulation	Barrier	Habit reversal	"I've never been one for exercise" #360, control group, non-faller, female
Physical Capability /Physical skills	Enabler	Previous knowledge and experience	"I have always exercised, since a young age, and appreciate the need to keep active." #148, intervention group, female;
	Barrier	Reduced physical stamina	"short of breath means I can't do many exercises" #328, intervention group, female

6.4.1.2 Reduced Capability as a barrier to fall prevention behaviour

In contrast to those who received the falls education intervention, control group participants were less psychologically prepared to overcome difficulties faced upon returning home from hospital. This was expressed by a participant who experienced adverse events of frequent falls and a hospital readmission,"yeah, I expected to be able to do a lot more than I was able to, and then when I got home, I realized that I wasn't anywhere near as prepared as I should have been" (#313, control, male).

Participants described an ongoing lack of physical capability after being discharged home from hospital, characterized by ongoing fatigue or pain. Safe mobility was compromised by this participant who was attempting to preserve his energy when mobilizing in the home:

> "I could push the walker around my home once or twice when the occupational therapist came to check on me, but when you need to do this repeatedly throughout the day, especially on the carpet, I prefer to just hold onto the furniture" (#313, control, male).

6.4.2 Super-Ordinate Theme 2. Opportunity to access fall prevention activities

Social and physical opportunity found within participants' lived environment and life circumstances after hospital discharge formed significant practical barriers or enablers to undertaking fall prevention activities. These themes along with exemplar participant level data are presented in Table 6.3.

Table 6.3. Opportunity barriers and enablers to fall prevention behaviour

Super-ordinate themes /TDF	Barrier or Enabler	Emergent theme	Exemplar quote
Physical Opportunity	Barrier	Discomfort	"When I'm cold I just stay in bed and don't exercise" #106, intervention group, non-faller, male.
/Environmental Context	Barrier	Environmental access	"My legs won't bend to get in the car #71, intervention, faller, male"
	Enabler	Access to equipment	"I found having a firm high back chair helped me to get up and out of the chair." #387, intervention group, non-faller, female.
	Barrier	Reduced access to supervised therapy	"I gradually dropped off one exercise then another when the physio stopped coming" #138, control group, faller, female.
	Enabler	Access to supervised therapy	"The home physio people were a big help for me, I did more of the standing exercises when they were with me." #120, intervention group, non-faller, male.
	Enabler	Access to social support	"The help was there all the time if I wanted, I could just ring them, which I was grateful for" #371, intervention group, non-faller, male.
	Enabler	Access to family assistance	"my son used to come and watch me cook until I felt strong enough to stand alone in the kitchen" #54, control group, non-faller, female.
	Barrier	Affordability	"Cleaning cost too much" #341, control group, non-faller, female.
	Enabler	Access to cleaning assistance	"I would have found life more difficult without the cleaning help – as I was off balance" #23 intervention group, non-faller, female.
	Barrier	Physical environment: hazards	I had to walk with a stick because the walker wouldn't roll on the carpet #313, control group, faller, male.
	Enabler	Physical cues	"There is a fair bit of danger when you're coming out of the shower recess, you could slip on the floor, so I make sure I hold the rails" #106, intervention group, non-faller, male.
	Enabler	Restructuring physical environment	"Before I just walked without a thought, but now I think more about it, and make sure there is a clear pathway" #120, intervention group, non-faller, male.

	Enabler	Soft cues through the education materials	"The education gave me a better possibility; I could use the information given to me to make the right choice" #23, intervention group, non-faller, female.
Social Opportunity /Social influences	Barrier	Lack of access to social support	"I wish someone would have told me it was going to be this difficult" #313, control group, faller, male.
	Enabler	Triggers from partner	"My wife and I said if we need assistance, we will accept it, and it definitely helped me to recover, once I got over my pride" #357, control group, non-faller, male.
	Enabler	Access to a trusted advisor	"I'm one of those people that's determined to do the right thing …I went to see the specialist and he passed me" #280, control group, female.
	Barrier	Family modelling negative behaviours	"My family don't exercise either" #360, control group, non-faller, female.
	Enabler	Family modelling positive behaviours	"My wife told me what to do, when you've been married for 40 years that's what you do" #120, intervention group, non-faller, male.

6.4.2.1 Opportunity to access fall prevention activities

Participants described multiple examples of how opportunities provided by carers, spouses, and therapists within the physical home environment, enabled fall prevention behaviour. For example, having more support from others after hospital discharge, including the availability and affordability of formal carers to assist with activities of daily living, was identified as an enabler for participants to enact their fall prevention action plan, "having the home help meant I could pace myself, I did a little bit here and a little bit there" (#387, intervention, female).

Physical opportunities to access necessary therapy, was also identified as an enabler for some participants to enact their falls prevention action plan. For example, one participant described how he safely progressed mobility under the supervision of a physiotherapist, "...they watched what I did, and had the wheelchair behind me. They made sure I didn't push myself and get out of breath, which was helpful" (#120, intervention, male). A participant who had access to physiotherapy gained understanding of their fall risks, which triggered uptake of fall prevention activities after hospital discharge:

> "I went to the physio, she gave me a test and made notes, and I was surprised at the things I couldn't do. They checked my balance and it wasn't good. I didn't realise how bad things had got; I've just been managing at home" (#53, intervention, male).

The presence of social opportunities through the support of a partner or family members was found to be an enabler for participants to engage in fall prevention activities after discharge home from hospital. For example, one participant considered the view of his spouse that reinforced his fall prevention behaviour, "It come hard when we had to ask for help, but we said if we needed it, we would definitely accept it" (#357, control, male).

Social opportunities provided through support of other caregivers was also identified as an enabler for participants to engage in fall prevention activities. For example, this participant described the support and feedback received by his formal (paid) care-giver, which reinforced his intention to continue a gradual and safe recovery after discharge, “They gave me feedback about how well I was doing, which made me feel like I could keep going” (#375, control group, male).

6.4.2.2 Lack of opportunity as a barrier to access fall prevention activities

Some participants described the experience of facing physical challenges within their lived environment that formed barriers to fall prevention after hospital discharge: “it was a bit more that I could manage, coming out of the hospital and into the home, the hospital environment is totally different, you have the aids in the hospital to hold onto that is totally different to being in the home” (#53, intervention, male).

Reduced social opportunity to access support from formal and informal carers was identified as an important barrier to fall prevention after hospital discharge, “In the early days, I found it hard to get through the day on my own” (#280, control, female). The cascade of negative effects from this lack of opportunity was widely described in personal stories of perseverance, with concern about how they could continue to manage without support after being discharge home from hospital, “I live completely on my own and I’ve got nobody to call if I need help, and that really worried me” (#341, control, female).

6.4.3 Super-Ordinate Theme 3. Motivation to engage in fall prevention activities

The motivation to prevent falls was described by participants through their willingness to engage in fall prevention activities after discharge home from hospital. Emergent themes of motivation are presented in table 6.4, along with linked theoretical domains and exemplar participant quotes.

6.4.3.1 Motivation to engage in fall prevention activities

Participants' individual awareness of their own falls risks was an enabler to belief that fall prevention behaviour was warranted (reflective motivation), "for myself, I have a bad case of kyphosis, sort of bent over when I walk, so I'm more likely to fall when I stand, but I make sure I keep both hands on my walker, that really helps me to feel balanced" (#106, intervention, male). For participants who received the education, having knowledge and awareness to enact their fall prevention action plan was expressed, "The education gave me a better possibility; I could use the information given to me to make the right choice" (#23, intervention, female).

Reinforcement provided by a trusted source such as a therapist, was identified as an enabler (automatic motivation) for participants to undertake their exercise for fall prevention after hospital discharge:

> "My physio insisted that I try to stand up as straight as possible, which helps me to increase the strength of my back muscles to help me to stand up straight. I do my home program most days" (#106, intervention, male).

Participation in fall prevention activities such as physiotherapy directed exercises, had an enabling influence on participant motivation to continue to engage in a fall prevention action plan, "They wanted 100% but I gave 150%. I really worked on everything" (#328, intervention, female).

6.4.3.2 Motivation as a barrier to engagement in fall prevention

Motivation for participants to undertake fall prevention activities was influenced by their perceived loss of function and mobility. This participant who reported falls with a serious injury, attributed the cause of the fall to external environmental factors, and continued to believe that fall prevention was beyond his control, “before going to hospital, I never thought about falls at all, because I could get around pretty well and it didn’t occur to me that a fall would happen” (#53, intervention, male).

Table 6.4. Motivation barriers and enablers to fall prevention behaviour

SUPER-ORDINATE THEMES /TDF	Barriers or Enablers	Emergent theme	Exemplar quote
Motivation (Reflective)			
/Beliefs about Capabilities and Consequences	Enabler	Confidence	"Exercise increased my confidence with moving" #106, intervention group, male. "If I don't think I can do it safely I avoid it" #280, control, non-faller, female
	Barrier	Unrealistic expectations	"I wish they had told me that it's not going to be as easy as I was thinking it was going to be" #313, control group, faller, male.
	Barriers	Awareness of falls risks without a plan	"I was a little bit off balance in the earlier days, I was too tense and too scared that I was going to fall again" #120, intervention group, non-faller, male
	Enabler	Awareness of falls risks with a plan	"I have a bad case of kyphosis, sort of bent over when I walk, so that increases my risk of falling when I stand" #106, intervention group, non-faller, male
/Role and Identity	Barriers	Belief in need to do it enough	"I don't need to exercise as often; I've gone past that stage."#131, control, faller, male. "I don't worry (about exercise) I leave the exercise to my husband, while I focus on the other jobs around the house" #360, control group, non-faller, female.
	Enabler	Self-image maintained	"The education made me feel like I was an ordinary person" #23, intervention group, non-faller, female.
	Enabler	Trusted advisor	"I'm one of those people that's determined to do the right thing …I went to see the specialist and he passed me" #280, control group, non-faller, female
/Optimism	Enabler	Exercise experience was new	"I had improved quite a lot and I was most amazed because they were very simple exercises" #23, intervention group, non-faller, female.

6.5 Discussion

This study found that absence of opportunities provided by the physical and social environment of older adults after returning home from hospital, could be either a barrier or enabler to engagement in fall prevention activities. This concurs with previous findings showing that people who received tailored education did not have significantly higher levels of engagement in fall prevention activities than participants who received usual care (Naseri et al., 2019). Health behaviour change theory suggests that along with having knowledge and motivation, people require opportunity within their environment to enable behavioural change (Michie, van Stralen, & West, 2011). These current findings confirm that older adults who were recently hospitalised face significant barriers to accessing sufficient physical and social support to address functional decline (Greysen et al., 2016; Krumholz, 2013).

Participants described difficulties with accessing supports, particularly with activities of daily living (ADLs) (Naseri et al., 2019). Other pragmatic trials evaluating education for older adults who were recently hospitalized also showed that behaviour change was mediated by post-hospitalisation contextual factors, including social and physical access to support (Hill et al., 2013). Barriers to behaviour change identified in this population include fatigue (Hill, Hoffmann, McPhail, Beer, Hill, Brauer, et al., 2011), and low levels of knowledge about how to reduce risk of falls (Hill et al., 2013). Having to face daily challenges after hospital discharge (Grimmer, Moss & Falco, 2004), can intensify other difficulties they may be experiencing such as with their self-care, diet, and medication regime (Greysen et al., 2016 ; Neiterman, 2015). This trajectory tends to lead onto fall-related injuries, hospital re-admissions, and sustained functional decline (Covinsky et al., 2011; Hoffman et al., 2019; Jencks et al., 2009).

A common theme articulated amongst participants in this study was of difficulty persevering with activities that would assist their recovery. The post-hospitalisation recovery period has been characterised by older adults prematurely taking risks (Haines et al., 2012).

Others avoid necessary activities (Gill et al., 2010), which compounds their diminished function (Krumholz, 2013), and increases the risk of hospital readmission (Hoffman et al., 2019; Liu-Ambrose et al., 2019).

Personal accounts confirmed that some older adults have trouble recovering their function after hospital discharge (Boyd et al., 2008; Mudge et al., 2014). This was accompanied by concern for their ongoing risk of falls and frustration, as they tried to manage their daily activities. Our previous evaluation revealed that 60% of the total population had unmet ADL needs (Naseri et al., 2019). This is known to increase the risk of hospital readmission (Depalma et al., 2013), and falls (Hass, DePalma, Craig, Xu, & Sands, 2017). In contrast, participants who received support from health professionals, family members, or formal carers after hospital discharge, expressed optimism in managing their fall risks. This concurs with previous findings showing that integrated care between healthcare professionals and caregivers at the time of hospital discharge can help reduce risk-taking behaviour (Haines et al., 2012; Hill et al., 2013).

Although the tailored education program may have empowered participants to be more knowledgeable and motivated to accept support at the time of hospital discharge, findings indicate more healthcare input was required to activate enough integrated support between healthcare professionals and caregivers, to ensure needs were met. This finding is consistent with previous trials of discharge care interventions (Naylor et al., 1999; Weiss et al., 2019). The incorporation of a tailored fall prevention program enabled participant optimism to manage their recovery after discharge home from hospital, which is known to help mitigate the high risk of falls and readmissions (Shuman et al., 2019; Weiss et al., 2019). Beyond the need to be informed and motivated about what they should do to prevent falls (Haines et al., 2016; Hill et al., 2016), participants overwhelmingly reported a need for more healthcare and transitional support after hospital discharge. Findings indicate that further healthcare and social support is needed for older adults over the extended recovery period after discharge

home from hospital. Recovering older adults face complexities at many levels that influence fall prevention behaviours, including overcoming a recent medical illness and ongoing functional decline. These challenges are less predictable at the time of hospital discharge and therefore more likely to be influenced by integrated care and support once older adults return home from hospital.

The evaluation of the long-term impact of a tailored education program using a validated behaviour change framework (Michie, van Stralen, & West, 2011), was a strength of this study. In addition, the qualitative findings provided credible, real-world perspectives of older adults recently hospitalised, generalisable to high-risk older populations.

Further investigation of the problems encountered by older adults after hospital discharge would be augmented by interviewing caregivers and community support providers. This could help to understand participants' experiences and broader complexities that older adults face within their social and physical environment after hospital discharge.

6.5.1 Conclusion

This evaluation confirmed there were gaps between participants' individual capacity for behaviour change and external life demands once they reached home, that could not necessarily be predicted or controlled during education delivery while in hospital. While tailored education assisted older adults to gain knowledge (capability) and motivation to manage their falls risks, further healthcare and social support was required over the extended period after hospital discharge, to enable participants to undertake action plans for fall prevention and recovery of function.

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CHAPTER 7 SYNTHESIS AND CONCLUSION

Preface

This chapter summarises and synthesises the findings from the research conducted as part of this thesis. This research provides new evidence about how tailored fall prevention education facilitates the engagement of older adults in fall prevention strategies after they have been discharged home from hospital. Strengths and limitations of the research are discussed, and the thesis concludes with recommendations for clinical practice and future research.

7.1 Overview of the Research

The problem of falls and associated ongoing costs for healthcare are recognised to be serious among older adults who have recently been discharged home from hospital (Hoffman et al., 2019). This population are known to be recovering from acute illness, but also from the lingering effects of their experience in hospital, an "acquired transient condition of generalised risk referred to as post-hospital syndrome" (Krumholz, 2013). Discharge care interventions have been found to promote self-care and may prepare older adults to an extent for their imminent discharge home from hospital. However, individuals still face unexpected challenges after they return home (Greysen et al., 2016), and adverse events including falls and hospital readmissions remain common (Leppin, Gionfriddo, Kessler, et al., 2014; Shepperd et al., 2013). As a clinician and researcher, I recognized gaps in the evidence for effective fall prevention interventions for older adults recently discharged home from hospital.

An evidenced-based tailored fall prevention education program was delivered to older patients during an RCT (n=390) in addition to usual care (Hill et al., 2019) (see Appendix B). This intervention aimed to reduce falls incidence by facilitating engagement in a fall prevention action plan after hospital discharge. As the RCT was seeking to facilitate health behaviour change, it was also important to understand the process by which the intervention affected behaviour after discharges and the mediating factors (Abraham et al., 2015).

The education program was a complex health behaviour change intervention that was tailored to the individual participant, based on their identified falls risks, and projected barriers to fall prevention engagement after discharge home from hospital. According to the published protocol (Hill et al., 2017), the intervention was expected to facilitate a reduction in falls by increasing participant engagement in falls prevention strategies. Action planning focused on preparing participants for their imminent discharge from hospital and included fall prevention strategies such as completion of safe exercise, modification of home hazards, and seeking

assistance with daily activities to facilitate a gradual return of function. The tailored education intervention was evaluated in this thesis, by determining how participants' responded during the post-discharge period to the tailored education delivered at hospital discharge. The COM-B model that was used as a framework for the intervention design, was the basis for this evaluation (Michie, van Stralen, & West, 2011).

The purpose of the research described in this thesis was to evaluate the impact of the tailored education intervention delivered during the RCT, on participants' engagement in fall prevention within six months after discharge home from hospital. The study used a convergent embedded mixed method design (Creswell, 2014). Quantitative data regarding participant levels of engagement (study 1, chapter 4) and capability and motivation (study 2, chapter 5) to engage were gathered at baseline and at six months post discharge using structured surveys with likert scales and analysed using generalized linear modelling. While qualitative data (study 3, chapter 6) explored participants' perspectives of barriers and enablers to engagement in fall prevention strategies after hospital from a purposive sample, and analysed using interpretative phenomenological analysis (Smith, Flowers, & Larkin, 2009). According to the COM-B framework (Michie, van Stralen, & West, 2011), outcomes were mapped to participants' capability, opportunity, and motivation to enable a deeper consideration of the impact of the education on older adults' fall prevention behaviour. Triangulation of the quantitative and qualitative phases provided a more holistic and real-life understanding of the factors that would have mediated behaviour change within the context of participants' post-discharge life-circumstances, and hence the effectiveness of the education (Creswell, 2014).

7.2 Review of the Research Problem

The systematic review and meta-analyses in Chapter 2 of this thesis synthesised the best available evidence for effective fall prevention interventions for older adults recently discharged from hospital (Naseri et al., 2018). There were 12 studies of high quality included. Fall prevention interventions previously found to be effective in the general older population, were not necessarily transferrable to older adults recently discharged from hospital. Analyses of overall effects of the interventions did not reveal one particular intervention was more effective than the others. However, sub-group analysis showed home hazard minimisation had a significant fall prevention effect for older patients who had a history of falls prior to hospital admission (Cumming et al., 1999; Nikolaus & Bach, 2003); and nutritional supplementation for those participants who were malnourished (Neelemaat et al., 2012). The review identified features common to interventions that had a positive fall prevention effect were those that were tailored to the individual, and where supervision was provided over an extended period after hospital discharge.

7.3 Synthesis of Research Findings

7.3.1 Study 1: The effect of tailored education on fall prevention behaviour after hospital discharge

As an evaluation of an education intervention that was designed to impact fall prevention behaviour, it was important to first measure changes in participants' fall prevention behaviour – the "B" of the COM-B model (Michie, van Stralen, & West, 2011). The education intervention was based on a program previously found to be effective for improving knowledge and motivation of older adults to engage in fall prevention strategies (Hill, Etherton-Beer, & Haines, 2013; Hill, Hoffmann, McPhail, et al., 2011).

Aim: Study 1

The aim of this study (Chapter 4) was to evaluate the impact of tailored falls education intervention provided in addition to usual care, on older adult engagement in fall prevention strategies within six-months after hospital discharge, compared to control conditions (Naseri et al., 2018).

Outcomes were engagement in fall prevention strategies measured during structured interviews at baseline in hospital, then repeated at six-months post-hospitalisation using structured telephone interviews. At six months 76.4% of participants were eligible to complete the final survey for the evaluation. The results demonstrated that the education intervention did not significantly raise levels of engagement in fall prevention strategies following hospital discharge, particularly exercise and assistance with daily activities, above that of usual care (Naseri et al., 2019). More than half of the population from both groups were found to not be receiving assistance with their ADLs at six months follow-up, suggesting they may have prematurely returned to their normal daily activities. There were indications the overall population were struggling to regain their function during their recovery, with reduced exercise

doses (1 hour at follow-up compared to 3 hours at baseline, SD =1.12) and raised proportions of dependency at six months follow-up, demonstrated by lower levels of functional ability in ADL compared to baseline (AOR 1.4, 95%CI 0.8-2.0, p<0.01).

At the conclusion of this study, synthesis of results with health behaviour change theory demonstrated that tailored education alone delivered to older adults at the time of hospital discharge, was not sufficient to change their behaviour after discharge home. This raised the question of whether the education sufficiently raised participants' capability, motivation and opportunity to enable behaviour change (Michie, van Stralen, & West, 2011), and indicated further research was required.

7.3.2 Study 2: Older adult capability and motivation to engage in falls prevention strategies after hospital discharge

This study (Chapter 5) continued the evaluation of the tailored education intervention to help understand findings from Study 1, which was that older adults have limited engagement in fall prevention strategies once they return home from hospital. Previous evidence found that older adults have limited knowledge about fall prevention following hospital discharge (Hill, Hoffmann, Beer, et al., 2011), and believe that fall prevention activities are more important for other older people than for themselves (Haines, Day, Hill, Clemson, & Finch, 2014). It was unknown if the tailored education intervention delivered around hospital discharge sufficiently raised the intervention group participants' knowledge and motivation to facilitate engagement in desired fall prevention once they were discharged home from hospital.

Aim: Study 2

This study aimed to measure the impact of the education intervention on older adults' levels of capability and motivation to engage in fall prevention activities during the six months after hospital discharge, compared to control conditions.

The behaviour change theory utilised during the design of the education intervention incorporated the COM-B framework to identify active components that would facilitate post-discharge engagement in fall prevention (Hill et al., 2017). Capability and motivation components were framed as those internal to participants, such as their knowledge about fall prevention strategies (psychological capability), physical skills to carry-out the strategies (physical capability); and their willingness (motivation) to participate in fall prevention (Michie, van Stralen, & West, 2011). Data were gathered face to face using structured surveys and likert scale responses at baseline in hospital, repeated at hospital discharge, and finally via telephone at six-months post-discharge (concurrent with Study 1 data collection).

The key findings of Study 2 were the education intervention enabled participants to be more knowledgeable and ready to engage in fall prevention strategies earlier in their recovery at hospital discharge (-0.4, 95%CI -0.7, -0.2), $p<0.01$), and this was sustained at six-month follow-up. Education participants were also more motivated (-0.8, 95%CI -1.1, -0.5, $p<0.01$) than the control group as they believed the likelihood of falls and falls injuries applied not only to others, but to themselves. This was encouraging as older adults have previously been found to be reluctant to seek health information (Lee et al., 2015), or engage in fall prevention activities when they do not believe they are at risk of falls (Mihaljcic, Haines, Ponsford, & Stolwyk, 2017). In contrast, participants in the control group developed this knowledge later in their recovery, indicating they were more reliant upon their previous health knowledge and experience (Beier & Ackerman, 2005), and may have been more vulnerable to adverse events such as falls earlier in their recovery (Cheal & Clemson, 2001; Hoffman et al., 2019).

Another significant finding of study 2 was that participants in both groups were more aware of their post-discharge risks of losing independence at six months follow-up compared to when surveyed at baseline (intervention: -1.3, 95%CI -1.5,-1.1, $p<0.01$; control: -1.2, 95%CI -1.4, -1.0, $p<0.01$). This suggested participants' developed knowledge and awareness over time, most likely as they prematurely recommenced their daily activities after discharge.

Raised dependency scores at six-months found in Study 1 (Chapter 4) confirmed that most participants did not regain functional independence over the extended recovery period after hospital discharge. This concurred with previous evidence that older adults tend to take risks as they attempt to return to their normal functional activities, or may avoid regular activities due to fear of falling, leading to increased risk of falls and sustained functional decline (Gill, Allore, Gahbauer, & Murphy, 2010; Haines, Lee, O'Connell, McDermott, & Hoffmann, 2012; Hass, DePalma, Craig, Xu, & Sands, 2017).

Hence this process evaluation began to reveal the complexities of facilitating behavioural change in older adults who were recently hospitalized. Although the current study demonstrated that the tailored education significantly improved motivation and capability components at the time of discharge, the previous study (Chapter 4) showed no significant differences between groups in levels of engagement in fall prevention strategies (Naseri et al., 2019). This suggested that participants in the intervention group were more prepared to engage in fall prevention strategies at the time of hospital discharge but then were presented with barriers to behaviour change within their life-situation once they returned home. The opportunity provided to participants to support their engagement in fall prevention strategies following discharge home from hospital needed to be further explored.

7.3.3 Study 3: Exploration of older adult perspectives of barriers and enablers to engagement in fall prevention strategies following hospital discharge

Health behaviour change theory suggests that as well as capability and motivation, individuals require opportunities to change their behaviour (Michie, van Stralen, & West, 2011). To explore the post-hospitalisation effect of the tailored education intervention, it was important to also understand how social and physical opportunities faced by participants within their life-circumstances, influenced their fall prevention behaviours once they returned home.

Aim: Study 3

The aim of the study (Chapter 6) was to explore perspectives of older adults regarding the opportunity (barriers and enablers) they experienced to engaging in fall prevention activities during the six months after hospital discharge.

Based on findings from Study 2 (Chapter 5), we expected there were gaps between individual capacity for behaviour change and external life demands that could not necessarily be predicted or controlled during delivery in the RCT. This study was interested in exploring participant experiences of those external demands during the six-month recovery period after discharge. An exploratory approach using interpretative phenomenological analysis (Smith, Flowers, & Larkin, 2009), focused on the lived experience of a purposive sample (n=30) of participants, recruited as a part of the RCT. Data were collected using a semi-structured phone survey with questions framed around barriers and enablers to participant engagement in fall prevention activities. The exploration of effects of the tailored education on fall prevention behaviour required the use of the Theoretical Domains Framework linked to the COM-B model (Cane, O'Connor, & Michie, 2012). The focus was on the lived experience of participants in undertaking fall prevention activities after hospital discharge, and the meaning of this experience for them. Themes of high importance were those that progressed the

understanding of real-world situations affecting participant engagement in fall prevention activities. A final overall framework assisted to conceptualise how participant fall prevention behaviour was impacted by the presence or absence of barriers and enablers, categorised as important themes within the COM-B components (Michie, van Stralen, & West, 2011).

Personal stories confirmed that some older adults have difficulty recovering their functional ability after hospital discharge. Reduced physical capability, such as experiences of fatigue ("short of breath means I can't do many exercises" #328), chronic pain and feeling unsteady when walking were barriers for participants to safely return to their normal daily activities. Participants who received the tailored fall education program reported positive effects on knowledge and motivation to engage in fall prevention, such as knowing how to prevent falls and feeling confident in undertaking the desired behaviours ("The education gave me a better possibility; I could use the information given to me to make the right choice" #23). Participants who had opportunities to access therapy or social supports had a more positive recovery compared to individuals who persevered without assistance ("They gave me feedback about how well I was doing, which made me feel like I could keep going" #375). A lack of opportunity to access physical and social support after hospital was associated with apprehension and fear toward adverse events such as falls, injuries, and hospital readmission ("I live completely on my own and I've got nobody to call if I need help, and that really worried me" #341). Exploration of participants' lived experience at six-month follow-up strongly suggested that they required more supports from both health care professionals and caregivers to ensure their needs were met, and enable them to engage in fall prevention activities after hospital discharge. This was represented by one participants' report "I wish someone would have told me it was going to be this difficult" #313.

7.4 Strengths of Research Findings

The findings of the evaluation were strengthened by the research methods of the thesis. It was preceded by a systematic review of evidence from 12 high-quality RCTs that found effective fall prevention interventions were tailored to the falls risk needs of the individual (Chapter 2) (Naseri, Haines, et al., 2018). The process evaluation was then conducted according to a published protocol (presented in Chapter 3 and Appendix C) (Naseri, McPhail, et al., 2018). It evaluated an RCT that delivered an evidenced-based tailored education intervention (presented in Appendix B) (Hill et al., 2019). This intervention was comprehensive and warranted based on evidence from previous trials that showed tailored education to assist older adults to personalise fall prevention strategies to their own circumstances, could improve engagement in fall prevention activities after hospital discharge (Hill et al., 2013; Hill et al., 2015).

The value and generalisability of these research findings were consolidated by the prospective nature of the evaluation that followed a broad cohort of older adults who were recruited as a part of a large RCT, from a representative sample of three metropolitan hospitals in Perth Western Australia (Hill et al., 2019). Compared to most discharge studies, this evaluation had a longer follow-up period, with minimal drop-out, to reveal the long-term impact of the tailored education and the complexities to enabling behavioural change in older adults who were recently hospitalized. Data were collected at six months after discharge to avoid influencing engagement outcomes during the observation period.

The convergent embedded mixed-methods design was a strong point of this research conducted for this thesis (Creswell, 2014). By utilising quantitative and qualitative data sources, both forms of data simultaneously played a supportive role to the other through triangulation of findings. Triangulation of quantitative with qualitative findings strengthened our research evidence by showing the effect of the education was not theoretical or

hypothesised, but real and observable. As the research focused on seeking to understand the complex problem of behaviour change, the mixed-methods design enabled a deeper understanding of the intervention effectiveness as well as how older adults experienced the process of fall prevention engagement. The qualitative methods used in the research strengthened the overall findings. The researcher developed a rapport with participants by taking both an empathetic and enquiring stance to understand participant perspectives about undertaking fall prevention activities following hospital discharge (Smith, Flowers, & Larkin, 2009). The qualitative patient-centred outcomes enabled clarification of COM-B components affected by the intervention, and validated barriers and enablers to fall prevention within the context of older adults' real-life circumstance after hospital discharge.

The tailored falls prevention education intervention was designed using the Behaviour Change Wheel framework as a basis for identifying what it would take to achieve the target health behaviour of engagement in falls prevention strategies in terms of changes to participants' Capability, Opportunity and Motivation (the COM-B system) (Michie, van Stralen, & West, 2011). This system matches the features of the intervention to those of the target behaviour and the context of the target population (Michie, 2014). The COM-B framework was used as a unifying theory, to measure what components of the behaviour change system were influenced by the intervention, where and when (Abraham et al., 2015). The use of the TDF that was linked to the COM-B model (Cane, O'Connor, & Michie, 2012), helped to account for the wide range of emergent barriers and enablers that affected participants' fall prevention engagement in the context of their life-circumstances after hospital discharge.

The research of this thesis has demonstrated that tailored education alone significantly improved levels of Capability and Motivation early in participants' recovery after hospital discharge, however this was not enough to change Behaviour over the six-month period after hospital discharge. Triangulation of quantitative results (Chapter 4 and 5) with qualitative

reports in the final study (Chapter 6) confirmed there were gaps in Opportunity for participants to engage in fall prevention once they reached home. Further exploration of real-life experiences in the final study revealed that barriers faced by participants within the six months after hospital discharge, were unlikely to have been predicted and therefore controlled during the RCT while the participant was in hospital.

Therefore, the tailored education alone was unable to prospectively address the barriers that participants were going to face within the context of their life-circumstances after hospital discharge. The tailored education intervention is warranted based on the significant findings in Study 2 (Chapter 5) that participants who received the education were more knowledgeable and willing to engage in fall prevention after hospital discharge. Study 3 (Chapter 6) while revealing barriers, also highlighted the enablers to fall prevention engagement. For instance, those participants who had the opportunity to receive therapy and support in the home were more likely to report positive experiences of recovery of their independence, and engagement in fall prevention strategies. To address the gaps in physical and social opportunity identified in study 3, integrated care between health and care providers once older patients reach home would be recommended, to provide progressive therapy, care-support and gradually enable independence over the extended recovery period.

7.5 Limitations and Challenges of the Research

This evaluation was limited by the nature of the population being drawn from older hospitalised patients who were admitted to rehabilitation wards, and the focus was on their recovery from hospitalisation and medial illness. A phone interview was selected rather than a focus group, or face to face interview, as participants had previously received monthly phone monitoring of falls data from the RCT, so the researcher (CN) had established a genuine rapport and reciprocity with the participants (Liamputtong, 2017). As participants were generally still recovering from a recent illness, a phone interview was considered more convenient than attending a clinic and allowed more complete responses. Participants were invited to give a response if they so desired, some participants choosing not to respond fully due to fatigue, reluctance to answer questions regarding their recovery, or time-limitations for open-ended questions. Survey questions were formulated using likert scales which are known to have strong validity for measuring attitudes and belief (Hartley, 2014), however, the measures were reliant on participants responses based on their perceived capability, motivation and opportunity. Participant responses were clarified with open probing questions and accepted as real and valid responses based on their own perception (Creswell, 2014).

The researcher conducting the surveys for this study also conducted monthly monitoring of falls by phone during the six-month observation period as a part of the RCT (Hill et al., 2019). As the researcher developed a rapport with participants over the period, this presented some strengths and limitations for the evaluation. Participants may have related to the researcher as a trusted healthcare professional who they reported to on a regular basis, however, this could also have influenced participants' responses during the final survey. The researcher remained open and free of assumptions and bracketed pre-existing theoretical understanding during data collection and analysis (Smith, Flower & Larkin, 2009).

As the tailored fall prevention education aimed to change individuals' health behaviours, it presented a research challenge for identifying effective components, reporting of findings, and subsequent replication (Craig et al., 2008). This challenge was addressed through the use of a validated behaviour change framework (Michie, van Stralen, & West, 2011). The robust tool enabled evaluation of the intervention components and exploration of moderating factors pertinent to the population of older adults recently discharged from hospital (Cane, O'Connor, & Michie, 2012; Michie et al., 2015).

The evaluation found there were early differences in engagement in both groups at the time of hospital discharge compared to baseline at admission, however, there were no significant differences in engagement levels between intervention and control groups. Approximately 25% of participants in both groups had higher engagement in falls prevention strategies at follow-up, including exercise, formal assistance with ADLs and IADLs, and acceptance of an OT home-visit at discharge. A possible explanation for the lack of intervention effect, was that since the tailored fall prevention education was successfully piloted in 2013 (Hill et al), fall prevention education may have been translated into current usual care practices and diluted the effect of the tailored education intervention during the RCT (Hill et al., 2019). This may reflect an improvement in the implementation of evidenced-based fall prevention as a part of discharge care in Western Australian hospitals, however the potential external influence did not result in a fall prevention effect for participants in the RCT, as the rate of falls and falls injuries remained high in both groups (Hill et al., 2019).

7.6 Recommendations of the Research

7.6.1 Implications for Practice

Despite efforts by health systems to improve discharge care, there has been limited progress of reducing falls and falls injuries for older adults following hospital discharge. Underlying post-discharge falls prevention programs are the concepts of patient-centred care, incorporating a shift in control of healthcare from those who normally provide it, into the hands of those who receive it, the patients themselves (Berwick, 2009). This dimension of discharge care values patient's attributions of their own falls risks and deepens health system understanding of what patients want to know and how to help them to know it, with the expectation that they will eventually make more informed health decisions (Hibbard, Peters, Dixon, & Tusler, 2007).

The impact of the tailored education on engagement in falls prevention strategies needs to be interpreted in the context of the high post-discharge falls in both groups, with 42.9% of total participants falling and 49.7% of these falls being injurious (Hill et al., 2019). Falls are a measurable sign of the generalised risk in this older population with fluctuating co-morbidities, who are still recovering from an acute health crisis, and post-discharge effects of hospitalisation (Krumholz, 2013).

More than half of the population did not seek assistance with their ADLs, suggesting they did not take time to gradually re-commence their usual daily activities in a safe manner, known to influence falls risks and their functional decline (Covinsky, Pierluissi, & Johnston, 2011). While a third of participants within groups completed a supervised program once per week for a median of 45 minutes, the dose was less than recommended falls prevention guidelines of at least 3 hours per week (Sherrington et al., 2017). The preference made by participants to complete a reduced dose of exercise in their own time at home without health

professional supervision is consistent with previous observations (Sherrington et al., 2014; Hill, Hoffmann, McPhail, et al., 2011). This may indicate that this population require more formal supports from health professionals to take up evidenced based exercise programs during the post discharge period.

Despite the lack of intervention effect on fall prevention engagement following hospital discharge compared to control conditions, the positive effects of the tailored education on participants' capability, motivation and opportunity must be acknowledged. Participants who received the education were more knowledgeable and aware of falls risks and fall prevention strategies at the time of hospital discharge, and this was sustained at six-months. This indicates that the tailored education prepared the participants to engage in fall prevention earlier in their recovery compared to usual care. It shows the education intervention can address the problems of recently hospitalised older adults having reduced knowledge of effective fall prevention strategies (Hill, Hoffmann, Beer, et al., 2011), a reluctance to acknowledge their falls risks (Lee et al., 2015), and belief they are already doing enough to prevent falls (Haines et al., 2012).

The tailored education intervention was also an effective means of actively engaging older adults and their caregivers in decisions relating to their health care once they return home from hospital, which has been shown to be important for enhancing self-management and health outcomes (Coulter & Ellins, 2007; Hoffman, Shuman, Montie, Anderson, & Titler, 2019). Although some external social and environmental barriers to fall prevention engagement were considered at the time the tailored education intervention was delivered, some were not foreseeable to educators or patients and therefore could not be controlled during the RCT. Educators prepared patients to engage with available supports delivered through hospital and community organizations, however the intervention did not deliver direct support in the home and community. This is consistent with previous evidence that this population tend to be passive when given a list of recommendations (Tinetti, Gordon, Sogolow, Lapin, &

Bradley, 2006), whereas direct high intensity interventions that directly address risk factors are likely to be more effective (Gates, Fisher, Cooke, Carter, & Lamb, 2008). There appeared to be substantial gaps between their capacity for engagement in fall prevention activities, and external demands in their lived environment. Beyond the need to be informed and motivated about what they should do to prevent falls, participants overwhelmingly demonstrated a need for more healthcare and transitional support after hospital discharge to enable them to commence action plans. Findings suggest that tailored education may be optimally provided over an extended period that includes when the patient is in hospital and after their return home, to ensure they are supported to undertake fall prevention strategies, and safely regain their independence in their home and community.

7.6.2 Implications for Research

This was the first evaluation of a tailored fall prevention education intervention that aimed at the point of hospital discharge to prospectively change health behaviour after patients returned home from hospital. A key function of this evaluation was to draw on the intervention's theoretical framework and the populations' contextual factors to understand the interventions' effectiveness in modifying behaviour. Findings from this study conferred that interventions delivered at the time of hospital discharge are limited in their ability to predict and change fall prevention behaviour in the post-discharge setting. This presents a clinical research imperative to understand potential gaps in health system discharge care as well as shortcomings of initiatives to support older adults during transitions from hospital to home.

Previously successful trials of falls education required participants to change their behaviours in a relatively structured ward environment (Haines et al., 2011; Hill et al, 2015), whereas this trial was the first that aimed to change behaviours in the less predictable post-discharge setting of the lived-environment, where participants contended with pre-existing cues to behaviour. Even though the tailored education promoted early stages of behaviour

change and participants were prepared to engage in falls prevention strategies, previous evidence shows they would have faced unexpected barriers following hospital discharge (Greysen et al., 2016), thereby limiting the education interventions' effect in the context of participants' life-situation post-discharge. Further investigation of the problems encountered by older adults after hospital discharge would be augmented by interviewing caregivers and community support providers. This could help to understand participants' experiences and broader complexities that older adults face within their social and physical environment after hospital discharge.

The tailored education intervention prepared participants for imminent functional decline associated with hospitalisation (Covinsky et al., 2003; Gill et al., 2010), by empowering them to delegate some assistance with their daily activities after hospital discharge. We know from dependency trends demonstrated in study 1, that participants went home from hospital with greater dependency, and the proportion of dependency remained higher at six-months compared to pre-admission levels. Unmet needs have previously been found to contribute to incidence of falls and hospital re-admissions (Beach et al., 2018; Sands et al., 2006), and other negative consequences including reduced food intake, dehydration, delirium, and pain (Mahoney, Mahoney, Morano, & Devellis, 2018). Concurrent with raised dependency trends at six-month follow-up compared to baseline, there was a significant increase in knowledge and awareness of the risk of losing function in both groups. This finding warrants further investigation to understand the possible impact of including content regarding the likely loss of function and independence as a necessary component of fall prevention education for older adults preparing for hospital discharge.

Although the multi-factorial nature of the tailored education intervention was considered appropriate for this post-discharge older population, the timing of content delivery regarding managing their falls risks may have needed to be progressively delivered according to the participants' recovery in their home environment. A recent network meta-analysis

indicated that combining such falls prevention interventions as exercise with vision assessment, and osteoporosis therapy may prevent injurious falls compared to usual care, however subgroup analysis found that combining falls interventions like exercise, environmental assessment and modification, and multifactorial assessment and treatment was associated with an increased risk of injurious falls among patients who had fallen previously (Tricco et al., 2017). The findings of this evaluation concur with this evidence and suggest a tailored approach may be critical when implementing falls interventions for this high-risk population, rather than applying the evidence directly.

7.7 Conclusion

This process evaluation highlights the importance of incorporating patient-centred outcomes in clinical trials. It improved understanding of how older patients manage their own health as they transition from hospital to home, and contributes to improving discharge and transitional care as a hospital-centred priority. Participants who received the tailored education intervention were found to be significantly more capable and motivated to engage in fall prevention activities at the time of hospital discharge, but then faced barriers to engagement after hospital discharge. The gap in opportunities to access fall prevention activities was confirmed during triangulation of qualitative findings, characterised by participants' stories of frustration at not being able to safely return to normal function or complete fall prevention action plans. These findings suggest that further tailored support that was integrated between healthcare and care providers in the community after hospital discharge may have provided opportunities for participants to undertake their individualised action plan and improve their safety and functional ability.

Further research is required to understand the barriers faced by older adults after discharge home from hospital, and to consider how tailored education, either solely, or as a component of other interventions can best support older adults to regain functional ability and remain safe after discharge from hospital.

7.8 References

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APPENDIX A CO-AUTHOR SIGNED CONSENT FORMS

The declarations referred to in the statement are the statements of contribution to authorship contained in the published articles submitted as a part of Chiara Naseri's thesis.

Re: published articles and articles under review in thesis

I consent to the inclusion of papers I co-authored in this thesis submitted by Chiara Naseri and accept the declaration made by the author. (Signatures removed from e space version)

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APPENDIX B Hill et al., 2019 Pre-Published Manuscript

This is the author's pre-published manuscript.

The reference for the manuscript is

Falls after Hospital Discharge: A Randomized Clinical Trial of Individualized Multimodal Falls Prevention Education

Anne-Marie Hill; Steven M McPhail; Terry P Haines; Meg E Morris; Christopher Etherton- Beer; Ronald Shorr; Leon Flicker; Max Bulsara; Nicholas Waldron; Den-Ching A Lee; Jacqueline Francis-Coad; Amanda Boudville

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Title

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Key words

Accidental falls, Patient discharge, Patient education, Randomized controlled trial

Abstract

Background

Older people are at high risk of falls after hospital discharge. The study aimed to evaluate the effect of providing individualized falls prevention education in addition to usual care on falls rates in older people after hospital discharge compared to providing a social intervention in addition to usual care.

Methods

A randomized clinical trial at three hospitals in Western Australia: participants followed for six months after discharge. Baseline and outcomes measured by assessors masked to group allocation. Participants: aged 60 years and over, admitted for rehabilitation. Eligibility included: cognitively able to undertake education (Abbreviated mental test score >7/10).

Intervention: tailored education comprising patient video and workbook, structured discussion and goal setting led by trained therapist. Main outcomes: falls in the six months after discharge; proportion of participants sustaining one or more falls.

Results

There were 382 (194 intervention: 188 control) participants [mean age 77.7 (SD 8.7) years]. There were 378 falls (fall rate/1000 patient days, 5.9 intervention; 5.9 control) reported by 164 (42.9%) participants in the six months following hospital discharge; 188 (49.7%) of these falls were injurious. There were no significant differences in falls rates between intervention and control groups: [adjusted IRR, 1.09; 95% CI (0.78 to 1.52)] or the proportion of participants who fell once or more [adjusted OR, 1.37; 95% CI (0.90 to 2.07)].

Conclusions

Providing individualized falls prevention education prior to discharge did not reduce falls at home after discharge. Further research is warranted to investigate how to reduce falls during this high-risk transition period.

Introduction

Falls are a significant problem for older people recently discharged from acute medical, orthopaedic, aged care or rehabilitation wards, with up to 40% falling in the six months after discharge (1-3). A prior history of falls also increases the risk of post hospital falls (1,2). Up to 50% of older people who fall sustain an injury after discharge and between 10% and 15% require readmission to hospital (1,3). Associated adverse events include functional decline, unplanned readmission, and hip fractures in the transition period from hospital to home (4-7). Interventions to improve the transition from hospital to home have yielded mixed outcomes, especially for older people with complex needs (8-10).

There is strong evidence that exercise as a single intervention significantly reduces injurious falls (11). However, post hospital discharge there is limited and comparatively low-quality evidence about the efficacy of falls prevention interventions for older people (12). Older people are known to have low levels of knowledge and motivation to engage in falls prevention after hospital discharge (13,14). But behavioural change interventions which engage older people in falls prevention strategies have only been tested in a limited number of studies (15,16). A systematic review suggested that providing fall prevention education either as a single or as part of a multifactorial intervention could increase the uptake of relevant strategies, but there was significant heterogeneity regarding the education intensity and duration and underlying theory. Interventions intensity also ranged from providing a brochure to a structured program of materials and face to face discussion of approximately one hour (16). Two trials that evaluated an education intervention in a hospital setting found the intervention reduced falls rates and injurious falls rates in hospitals (17,18). These provided inpatient fall prevention education using multimedia formats and tailored follow up by a therapist in approximately two to four 15-minute sessions. However, there was no sustained protective effect in the immediate discharge period (1), most likely because those education interventions were designed specifically for the inpatient setting.

Given the lack of attention to falls prevention after hospital discharge, we designed a tailored multimedia education program for older people that focused on actively addressing post hospital functional decline and capability and motivation regarding falls prevention.

Multimedia education has established efficacy for raising knowledge and awareness about falls prevention in older patients (19). A pilot trial also demonstrated that providing the tailored education increased engagement in falls prevention strategies for one month after discharge (20). The older people also responded positively to the education (20).

We aimed to evaluate the effect of providing a tailored multimedia falls prevention education program plus usual care on falls rates in the six months after hospital discharge.

Methods

Design

A single blinded randomized controlled trial was conducted in rehabilitation wards at three hospitals in Perth, Western Australia, using a two-group parallel design and adhering to the CONSORT guidelines (21). Hospital and university ethics committees approved the study. All participants provided written informed consent. The trial's protocol and description of the education intervention were published previously (20,22). Patients were enrolled from August 2015 to September 2017 and followed up for six months after discharge. Trial registration: Australian New Zealand Clinical Trials Registry (ACTRN12615000784516).

Participants

Participants and setting have been detailed previously (22). Briefly, participants were older patients admitted to participating hospital rehabilitation wards. Patients on these wards receive rehabilitation for new onset stroke or other neurological conditions, orthopaedic diagnoses such as hip fracture, functional decline, general medical conditions or reconditioning after acute surgery. Eligible patients were those who were community

dwelling (not admitted from nursing homes) and were 60 years of age older. Patients were included if they had sound cognitive function, classified as having an Abbreviated Mental Test Score >7/10 (23), and were able to receive telephone calls, as these two conditions were necessary to receive the education intervention. Patients were excluded if they had short stay admissions (<5 days), were receiving palliative care or had a medical plan for discharge to a nursing home.

Randomization

Participants were randomly allocated to either group in a 1:1 ratio. The computer-generated randomization sequence was prepared and sealed in consecutively numbered opaque envelopes by a researcher (located externally) who was not involved in recruitment, intervention delivery or assessments. The envelopes were held securely at an external university not accessible to the investigators. Each participant was assigned a trial identification number in the order of recruitment. After a participant's baseline assessment had been recorded, the trial manager telephoned a randomization gatekeeper at the external university who opened the next envelope to reveal group allocation.

Masking

Trained research officers masked to group allocation separately completed baseline and outcome measures. The participants were instructed not to reveal their group allocation to the assessors. Collected data were entered into a secure online database, with access provided only to these research officers.

Experimental group education intervention

Participants in the experimental group received the education intervention while in hospital in addition to usual care. Therapists commenced delivery of the allocated intervention within 48 hours. The education program has been described in detail previously (20,22). The program was piloted for use prior to the present trial to establish that the dosage and content

raised knowledge and motivation and engendered a positive response among older patients (20). The program used a workbook and digital video to initially present information about falls and falls prevention specific to the post discharge period. Therapists then had face to face structured discussions with each participant to tailor the information to be personally relevant for their medical and social circumstances. They helped each participant to develop a documented goal-oriented action plan to be used once they arrived home. The same therapist made a monthly phone call for three months after discharge to reinforce the education and to modify the plan as appropriate.

The education design and delivery were based on the concepts of the COM-B model of behavioural change theory (24). It aimed to: i) raise capability (knowledge and awareness about falls risk and falls prevention); ii) raise motivation to undertake and sustain falls prevention strategies; iii) assist participants to identify opportunity (both social and environmental) to implement falls prevention strategies and address barriers during the post discharge period. The content was based on three key areas: i) seeking assistance with personal care and other daily activities that, after discharge, participants were not able to undertake independently; ii) engaging in exercise to regain functional mobility; iii) planning to gradually re-commence usual activities and making home modifications if required to safely re-engage in usual activities. Strategies were undertaken with the aim of ensuring treatment fidelity (22). This included providing the three therapists (experienced in geriatric treatment and rehabilitation) with structured training to deliver the intervention. This training was provided by therapists with experience in designing and delivering falls prevention education. Therapists were also provided with a purpose-designed intervention workbook which they completed for each patient, recording weekly summaries of patient interactions, including telephone calls. Additionally, each stage of intervention completion was recorded, including session time, whether participants received the video and workbook materials, which key areas were identified as requiring a strategy to be developed with the patient and if a written action plan accompanied the participant at discharge. This action plan was

subsequently used by therapists to structure the telephone calls after discharge. The falls prevention education was designed to include two to four sessions in hospital (total approximately 45 minutes) and three telephone calls (total 60-minute contact) after discharge. However, therapists were also instructed to modify the time according to each participant's ability to engage with the education and time taken to develop their action plan to ensure that the desired intervention was delivered in its entirety.

Control group intervention

Control group participants received usual care plus a scripted education program of 45 minutes with a trained health professional that discussed aspects of positive ageing. It did not include any falls prevention or medical health information. If control group participants enquired about medical or falls prevention topics, the health professional advised and subsequently reminded them to discuss the topic with their usual hospital multidisciplinary team.

Usual care conditions

Usual care was provided on the hospital wards and when the participants went home. The educator therapists were employed by the university for the purposes of the trial alone. Participants at all three hospitals received comprehensive geriatric care from a multidisciplinary team. This consisted of comprehensive medical and allied health services, 24-hour nursing care, home visiting services, outpatient rehabilitation and a discharge summary.

Outcomes

The primary outcome was: i) the rate of falls in the six months following hospital discharge. Secondary outcomes were: ii) the rate of injurious falls; iii) proportion of participants who sustained one or more falls in the six months following hospital discharge. A fall was defined according to World Health Organization criteria as being "an event which results in a person coming to rest inadvertently on the ground or floor or other lower level (25)."

An injurious fall was defined as any fall reported which also resulted in an injury (18). Falls and falls injuries post discharge were measured using the falls diary issued to participants at discharge by the baseline research officer and follow-up telephone calls monthly for six months to every participant (26).

Other secondary outcomes were initially measured at baseline in hospital. Follow up measures were undertaken during a telephone interview conducted at six months after discharge. These outcomes were: iv) participants' functional ability, classified as activities of daily living (ADL) measured using the Katz index (27) and instrumental activities of daily living (IADL) measured using the Lawton's index (28); v) participants' health related quality of life (HRQOL) measured using the Assessment of Quality of Life -6 dimensions scale (AQOL-6D) (29).

Process evaluation

The process evaluation is detailed in a separate, previously published protocol (30). The educators facilitated intervention group participants to set individualized strategies in all three key content areas, appropriate for their personal health and social circumstances. These strategies were receiving assistance with ADL (either personal or instrumental activities), undertaking exercise and modifying their environment. The strategies undertaken were measured in both groups by participant self-report, at baseline in hospital and six months after discharge through telephone interview.

Statistical analysis

Sample size

The sample size estimate was based upon 80% power to detect a 30% relative reduction in the rate of falls (negative binomial incidence rate ratio =0.70) from a control rate of 0.80 falls per person over the six-month follow-up (two-tailed alpha =0.05) (1). We applied a 1:1 control to intervention allocation ratio and determined that a total sample size of n=372 was

required (31). We enrolled 390 participants to allow for a drop-out rate of approximately 5%.

All analyses were performed using Stata 15 (Stata Statistical Software, College Station, TX: StataCorp LLC) and following intention-to-treat principles. Between group comparisons at baseline were performed using $\chi 2$ tests (categorical variables), unpaired t-tests (Gaussian, interval or ratio variables) or Mann-Whitney U (ordinal / non-Gaussian variables). Statistical significance was set at 0.05. Between group comparisons for the primary outcome of rates of falls and the secondary outcome of rate of injurious falls were analysed using negative binomial regression with adjustment for participant's length of observation in the study. The proportion of people who become fallers during the observation period was compared between groups using logistic regression. Comparisons of primary and secondary fall-related outcomes between groups were adjusted for whether each participant fell or not during hospital admission, whether they fell in the six months prior to hospital admission, whether they received assistance with ADL prior to hospital admission, presence of a depressed mood at baseline as measured by the Geriatric Depression Scale (32) and whether the participant used a walking aid or not at baseline. Functional ability and HRQOL were compared between groups using linear regression with adjustment for the baseline values of each individual outcome respectively. Hospital site was included as a random effect in each regression (for primary and secondary outcomes) to account for potential clustering within sites.

Results

The flow of participants (n=390) is presented in the CONSORT flow chart in Figure 1. Eight participants were lost to follow up in hospital and 30 participants were lost to follow up during the post discharge period, hence 382 participants were included in final primary analyses and of those, 352 patients provided falls data for the complete six months of observation. There were no trial related adverse events (other than falls) reported to the investigators during the trial.

Demographic characteristics of participants are presented in Table 1. Participants were older adults [mean age intervention, 77.4 (±8.8); control, 78.1 (±8.5) years] and 70.9% had fallen in the 6 months prior to admission to hospital [intervention n=141 (72.7%); control n=130 (69.1%)].There were no significant differences between intervention and control groups, other than more control group participants were hospitalized in the 12 months prior to their current admission.

The investigators considered the intervention to have been delivered with a high level of fidelity. The median (IQR) number of sessions delivered was 3 (3-5) in hospital with 98% of intervention group participants receiving at least three sessions in a total time of 140 (110-185) minutes. There were 184 (94%) participants who additionally received three follow-up phone calls. Overall 188 (95.5%) control group participants received the healthy ageing education using a time of 45 (35-45) minutes. Intervention group participants developed a median (IQR) of 3 (3-5) goals to undertake strategies to reduce their risk of falling. The number of strategies undertaken by the intervention group was not significantly different to the control group (see Table 2).

There were no statistically significant differences between the intervention and control groups in the falls rate, injurious falls rate or proportion of participants who fell once or more (see Table 3). There were 378 falls reported by 164 (42.9%) participants in the six months following hospital discharge with 188 (49.7%) of the falls being injurious. Of the total falls 328 (86.8%) occurred at home and 50 (13.2%) (n=20 intervention, n=30 control) occurred when the participant was re-admitted to a hospital or admitted to a residential care setting after discharge. The overall falls rate was 5.9 per 1000 patient days and the injurious falls rate was 2.9 per 1000 patient days. Monthly falls rates demonstrated a reducing incidence over time. Of the 164 participants who fell, 79 fell once (n=43 intervention; n=36 control), 46 fell twice (n=26 intervention; n=20 control) and 39 fell more than twice (n=22 intervention; n=17 control).

Two hundred and ninety-two (82.9%) of the final 352 participants completed the final post discharge survey at six months, measuring functional ability (ADL and IADL) and HRQOL, which were compared with baseline measures (see Table 4). The most common reason for not completing the survey was admission to a nursing home during the six months after discharge (n=37) and hence no longer being able to engage in and report falls strategies relevant for community home dwellings. There were no significant differences between the groups in functional ability (ADL or IADL) or HRQOL at six months post discharge.

Discussion

This randomized trial found that providing a tailored education intervention, prior to hospital discharge plus telephone support after discharge did not reduce falls in the six months after hospital discharge. Therapists encouraged patients in a positive manner through the education to undertake necessary functional activities including exercise, in a graduated and safe manner. A previous RCT in a post discharge population found that exercise as a single intervention increased falls (2). However, exercise programs are important to address rehabilitation including functional decline, which can be a significant problem after hospital discharge (6). We hypothesized that encouraging participants to exercise to regain function, while concurrently providing safety messages that encouraged participant engagement in strategies addressing increased risk of falls, would reduce falls. As part of these safety messages we also encouraged participants to initiate home modifications. Home visits by an occupational therapist who provide home modifications have been found to reduce the risk of falling in patients with a previous history of falls (33).

The education intervention was intensive with each participant receiving individualized support and feedback from a trained therapist and results demonstrated strong uptake of tailored evidence-based strategies. However, use of these strategies was noted to be high in the control group as well, with no significant differences between the two groups. Our

intervention provided approximately two hours of face to face contact with the therapist which was more intensive than the pilot study (20). This was higher than planned (22) but was found to be required to enable therapists to maintain the fidelity of the intervention and spend sufficient time with these older participants to develop their written action plan. Over 98% of participants received the hospital component of the intervention, which included setting written goals to engage in tailored strategies after discharge. It was provided in addition to existing discharge plans of the patients own multidisciplinary team and included multimedia materials consistent with those that had demonstrated success in our earlier inpatient trials (18,19). There were some early differences in falls rates between the groups and it could be that the intervention group participants initiated behaviour change immediately following hospital discharge, which was not maintained by telephone call contact alone from therapists. Behaviour change is known to be mediated by the intervention components chosen (24) and our intervention aimed to raise capability and motivation. However, it may not have provided sufficient opportunity, including enablement, for participants to initiate and maintain desired strategies after discharge. It is also possible that the educational intervention provided patients with a safety advantage relative to the usual care control group in the first month after hospitalisation, but usual care interventions combined with natural recovery contributed to this advantage eroding over time until convergence of falls rates occurred at approximately 6 months. Another possible explanation for each group having similar fall- rates at 6 months was that hospitals in Australia may have incorporated formerly novel fall- prevention intervention strategies that were effective during the pilot for this study (1,20) into what is now considered to be usual care interventions. A large systematic review demonstrated that interventions tested more recently were less efficacious when compared with controls and suggested this could reflect general improvement over time in the standard of care delivered in this transition period (9).

Falls rates in both groups were higher than a similar randomized trial in this population (2),

possibly because our population was more functionally declined (having a longer hospital length of stay), although the increased rate of falls in the first month after discharge accords with trials in this population (2,3). Over 50% of the falls that occurred were injurious with a rate of one injurious fall per person year, with a sharp increase immediately after discharge, confirming the vulnerability to adverse events described in this population (4,34,35). These injuries accord with a US national study which demonstrated a sharp increase in hip fractures in the 30 days after discharge[4] and is twice the rate of injurious falls in trials conducted in general community-dwelling populations (36). Further research is warranted to determine if combined strategies promoted as part of our education are actually effective in reducing falls after discharge. The sample in this trial were at high risk as they were functionally declined and over 70% had fallen in the previous year. We observed that more participants from the intervention group fell once or more. A recent network meta-analysis found that combined interventions that included patient-level quality improvement strategies, environmental modifications and exercise, increased the risk of injurious falls among patients at high risk of falls (11).

Limitations of the program were that therapists only provided telephone support after discharge and could not directly address problems that arose for participants. Falls data were collected monthly, which accords with good practice for falls research (26), although we are uncertain if the three-monthly phone calls by therapists to the intervention group participants may have raised their awareness of reporting falls relative to the control group. This could have reduced early post discharge differences in falls rates between the groups. Another important consideration was the extent to which the study was at was risk of Type II error on account of our sample size target. Our a priori sample size estimate was based on our previous trial that achieved a relatively large effect within the first month after hospital discharge (1). We envisaged that this worthwhile effect could be maintained, but no such effect was evident at the 6-month primary endpoint in the present study. We concluded that the negative finding was likely to be genuine in this case, and not the product of an

insufficient sample size, due to the close similarity in each group's falls rate at the 6-month primary endpoint. There were also low levels of attrition, with falls data collected for six months of observation for more than 90% of participants.

Participants' levels of engagement in falls prevention strategies were measured at six months after discharge so as not to influence engagement during the observation period. Engagement may have been mediated by medical and social barriers after discharge which have been described previously (37) and a detailed process evaluation will identify barriers and intensity of engagement in tailored strategies (30). Furthermore, the intervention might not have addressed other post discharge problems sufficiently. Medical and social follow-up care in the community is an important consideration after discharge, as ongoing social and medical challenges are known to cause adverse events and contribute to readmission, both early and late after discharge (9,37). Further analyses of the participants' hospital readmissions, medical care and costs of care will be completed using patients' health records and healthcare costings data (22).

Conclusions

Providing tailored education for older people to assist them to safely transition from hospital to home did not reduce falls or injurious falls post discharge. Further research should investigate how falls and injury can be reduced among older people recently discharged from hospital.

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Tables

Table 1. Demographic characteristics of participants

Variable	Intervention n=194 (100%)	Control n=188 (100%)
Mean age, y, mean(SD)	77.4 (8.8)	78.1 (8.5)
Gender, female, n (%)	116 (59.8)	119 (63.3)
Length of stay in hospital, days, median (IQR)	27 (17-45)	25 (18-39.5)
Diagnosis, n (%)		
Stroke/other neurological	27 (13.9)	31 (16.5)
Musculoskeletal/arthritis	28 (14.4)	24 (12.8)
Orthopaedic	60 (30.9)	52 (27.7)
Cardiac/respiratory	18 (9.3)	26 (13.8)
Other geriatric management	61 (31.4)	55 (29.3)
Highest education level attained, n (%)		
Primary	24 (12.4)	30 (15.9)
Grade 10	87 (44.8)	89 (47.3)
Grade 12	20 (10.3)	24 (12.8)
College	36 (18.6)	26 (13.8)
University	27 (13.9)	19 (10.1)
Visual impairment,[a] n (%)	54 (27.8)	41 (21.8)
Hospital admission in year prior to current admission, n (%)	72 (37.1)	93 (49.5)

Fell in 6 months prior to hospital admission, n (%)	141 (72.7)	130 (69.1)
Fell during hospital admission, n (%)	18 (9.3)	17 (9.0)
≥4 medications prescribed at discharge, n (%)	175 (90.2)	167 (88.8)
Psychotropic medications prescribed at discharge n (%)	58 (29.9)	55 (29.3)
Discharge destination, n (%)		
Home alone	83 (42.8)	72 (38.3)
Home with partner	79 (40.7)	65 (34.6)
Home with other	16 (8.2)	35 (18.6)
Other[b]	16 (8.2)	16 (8.5)
Mobility, n (%)		
No aid	23 (11.9)	27 (14.4)
Walking stick	18 (9.3)	22 (11.7)
Walking frame	133 (68.6)	121 (64.4)
Wheelchair	20 (10.3)	18 (9.6)
Mood		
GDS,[c] mean(SD)	4.17 (2.8)	4.22 (2.8)
GDS≥5, n (%)	47 (24.2)	51 (27.1)
Functional ability prior to hospital admission, median (IQR)		
ADL[d]	6 (5-6)	6 (5-6)

IADL[e]	7 (5-8)	7 (5-8)
Functional ability at discharge, ADL,[e] median (IQR)	5 (3-6)	5 (3-6)

Note. ADL, activities of daily living; GDS, geriatric depression score; IADL instrumental activities of daily living; IQR, interquartile range; SD, standard deviation

a glaucoma, cataracts, macular degeneration

b transitional care facility or nursing home

c geriatric depression scale,[32] range from 0 to 15, score >4 indicates presence of depressive symptoms

d ADL measured using Katz index of independence in activities of daily living scale,[27] range from 0 to 6, higher score indicates more independence

e IADL measured using Lawton's instrumental activities of daily living scale,[28] range 0-8, higher score indicates more independence

Table 2. Falls prevention strategies reported by participants

Strategy reported	Intervention n=149 (100%)	Control n=143 (100%)	OR (95% CI), p-value[e,f]
Received formal[a] assistance with ADL/IADL through home care agency	97 (65.1)	92 (64.3)	1.28, (0.75 to 2.20), 0.36
Received informal[b] assistance with ADL/IADL	96 (64.4)	103 (72.0)	0.73, (0.43 to 1.24) 0.24
Engaged in exercise[c]	111 (74.5)	101 (70.6)	1.28, (0.76 to 2.17), 0.35
Home visit from hospital occupational therapist	95 (63.7)	89 (62.2)	1.02 (0.62 to 1.67), 0.93
Completed home modifications[d]	105 (70.5)	94 (65.7)	1.24, (0.76 to 2.04), 0.38

Note. ADL, activities of daily living; IADL, instrumental activities of daily living; OR, odds ratio

a formal means assistance provided by employed carers from community home care organisations for activities including showering, shopping, cooking and other personal care as required

b informal means assistance provided by family, friend or other for showering, shopping, cooking and other personal care as required

c any type of exercise, including walking, exercise program provided by health care professional, swimming or gym attendance

d includes all modifications provided by occupational therapist and those completed by the participant, family or other (such as rails, equipment, environmental alterations)

e clustered by site (3 sites)

f adjusted for levels reported at baseline

Table 3. Falls outcomes in the 6 months after hospital discharge

	Intervention group	Control group	Unadjusted[a] IRR or OR, (Robust 95% CI),p-value	Adjusted[a,b] IRR or OR, (Robust 95% CI),p-value
Falls/injurious falls/fractures/number of participants who fell one or more times, days of observation, n	194/98/9/91/32521	184/90/12/73/31004		
Falls rate (95% CI) per 1000 patient days)	5.9 (4.7 to 7.2)	5.9 (3.9 to 8.8)	1.0, (0.73 to 1.46), 0.85	1.09, (0.78 to 1.52), 0.61
Injurious falls rate (95% CI) per 1000 patient days)	2.7 (2.1 to 3.5)	3.1 (2.4 to 4.0)	0.88, (0.60 to 1.28), 0.49	0.86, (0.60 to 1.24), 0.42
Proportion of participants who fell one or more times %, (95% CI)	46.9 (40.0 to 54.0)	38.8 (32.0 to 46.0)	1.42, (0.95 to 2.14), 0.09	1.37, (0.90 to 2.07), 0.14

Note. IRR, incident rate ratio; OR, odds ratio

a analyses clustered by site (3 sites)

b adjusted for history of falls, requiring assistance with activities of daily living in 6 months prior to admission; sustaining a fall while in hospital; depressed mood, use of a gait aid at baseline

Table 4. Functional ability and health-related quality of life outcomes at 6 months after hospital discharge.

	Intervention n=149 (100%)	Control n=143 (100%)	Co-efficient, (95% CI), p-value[d]
Functional ability at 6 months, median (IQR)			
ADL[a]	6 (4-6)	6 (4-6)	0.91, (0.65 to 1.28), 0.60
IADL[b]	5 (5-6)	6 (5-6)	0.84, (0.65 to 1.09), 0.19
Health related quality of life at 6 months, AQOL6[c] mean SD)			
Independent living	0.4 (0.3)	0.4 (0.3)	1.00, (0.94 to 1.07), 0.90
Relationships	0.5 (0.3)	0.5 (0.3)	0.99, (0.93 to 1.06), 0.82
Mental health	0.7 (0.3)	0.7 (0.3)	0.98, (0.92 to 1.04), 0.53
Coping	0.6 (0.3)	0.6 (0.3)	0.95, (0.89 to 1.01), 0.12
Pain	0.5 (0.3)	0.6 (0.3)	0.94, (0.87 to 1.01), 0.10
Senses	0.9 (0.2)	0.9 (0.2)	1.01, (0.97 to 1.04), 0.67

Note. ADL, activities of daily living; AQOL6, Australian quality of life 6 dimension version; ADL instrumental activities of daily living; IQR, interquartile range; SD, standard deviation

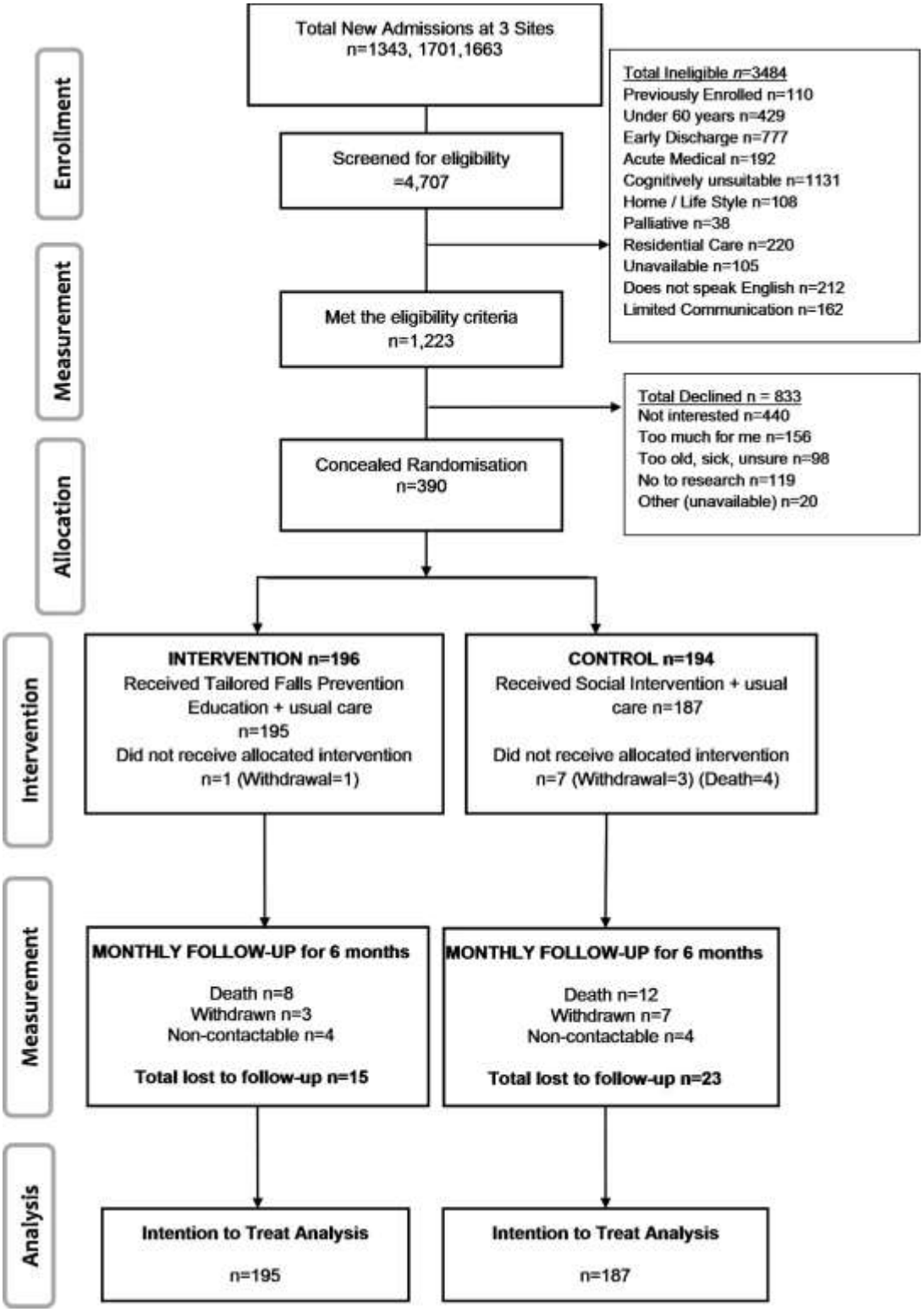
a ADL measured using Katz index of independence in activities of daily living scale,[27] range from 0 to 6, higher score indicates more independence

b IADL measured using Lawton's instrumental activities of daily living scale,[28] range 0-8, higher score indicates more independence.

c measured using AQOL 6,[29] range from 0 to1, higher scores indicate better self-perceived health-related quality of life

d adjusted for levels reported at baseline and clustered by site (3 sites)

Figure 1. Participant flow through the study



Conflict of Interest

Professor R. Shorr declares he serves as an expert witness regarding falls in hospital. The other authors have no conflicts to declare.

Acknowledgements

Author Contributions

AMH, TH, CEB, SMM led the study conception and design and MM, LF, NW, RS, MB contributed to study conception and design. AMH, SMM TH led overall trial procedures including intervention delivery protocols and data management. AMH and SMM led the statistical analyses with input from TH. LF, AB, CEB and NW contributed to overall trial management, including data collection and procedure and led trial management at the sites and JFC, DCL, MM contributed to intervention design, delivery, and evaluation. AMH was responsible for original manuscript drafting with support from SMM. All authors appraised the manuscript critically for intellectual content and read and approved the final manuscript.

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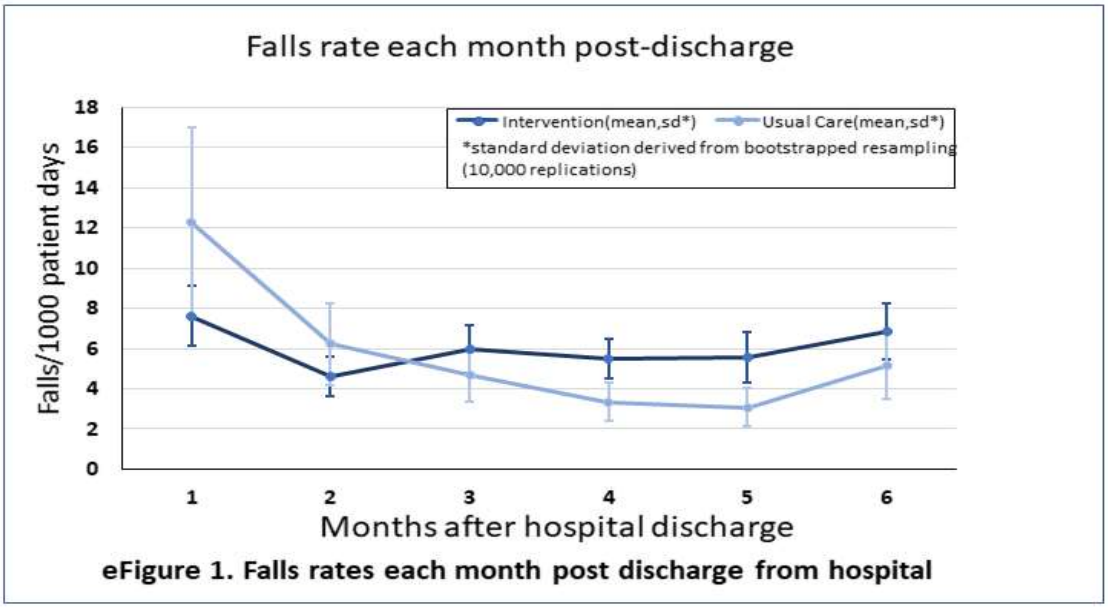
Supplementary File 2 – online publication

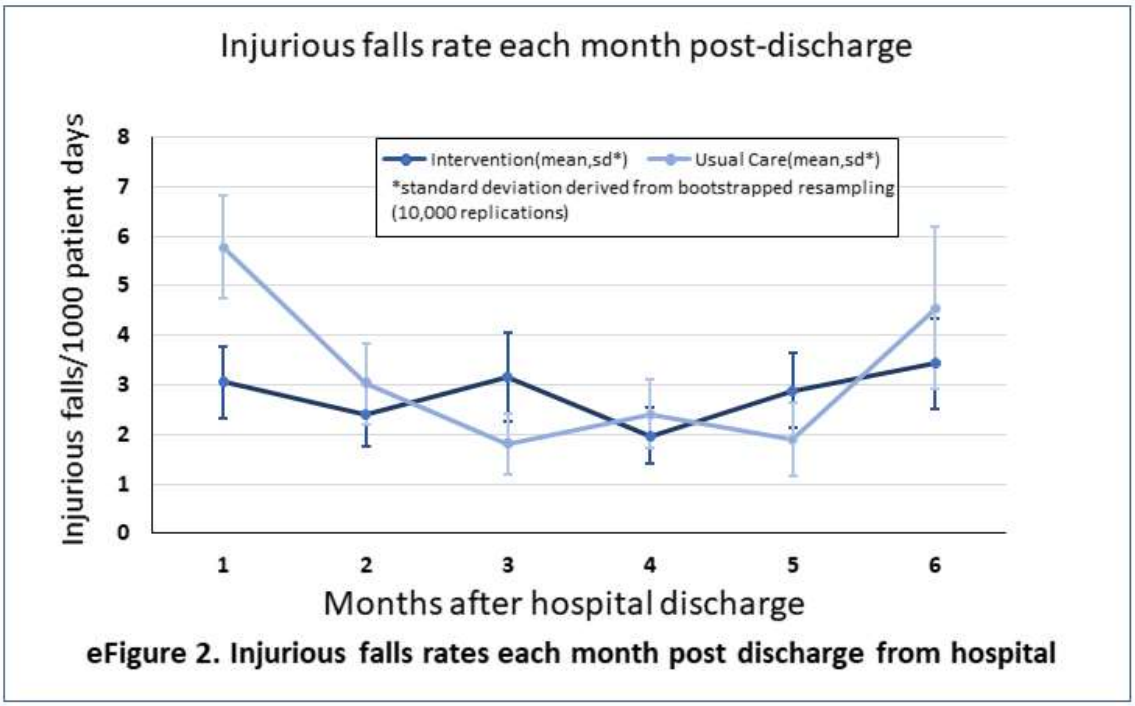
Manuscript Title: Falls after Hospital Discharge: A Randomized Clinical Trial of Individualized Multi-Modal Falls Prevention Education

eFigure 1. Falls rates each month post discharge from hospital

eFigure 2. Injurious falls rates each month post discharge from hospital



eFigure 1. Falls rates each month post discharge from hospital



eFigure 2. Injurious falls rates each month post discharge from hospital

APPENDIX C Open Access Published Protocol

Open Access Protocol

BMJ Open

Impact of tailored falls prevention education for older adults at hospital discharge on engagement in falls prevention strategies postdischarge: protocol for a process evaluation

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ABSTRACT

Introduction Older adults recently discharged from hospital have greater incidence of adverse events, functional decline, falls and subsequent readmission. Providing education to hospitalised patients on how to prevent falls at home could reduce postdischarge falls. There has been limited research investigating how older adults respond to tailored falls prevention education provided at hospital discharge. The aim of this study is to evaluate how providing tailored falls prevention education to older patients at the point of, and immediately after hospital discharge in addition to usual care, affects engagement in falls prevention strategies in the 6-months postdischarge period, including their capability and motivation to engage in falls prevention strategies.

Methods and analyses This prospective observational cohort study is a process evaluation of a randomised controlled trial, using an embedded mixed-method design. Participants (n=390) who have been enrolled in the trial are over the age of 60 years, scoring greater than 7/10 on the Abbreviated Mental Test Score. Participants are being discharged from hospital rehabilitation wards in Perth, Western Australia, and followed up for 6 months postdischarge. Primary outcome measures for the process evaluation are engagement in falls prevention strategies, including exercise, home modifications and receiving assistance with activities of daily living. Secondary outcomes will measure capability, motivation and opportunity to engage in falls prevention strategies, based on the constructs of the Capability Opportunity Motivation Behaviour system. Quantitative data are collected at baseline, then at 6 months postdischarge using structured phone interviews. Qualitative data are collected from a purposive sample of the cohort, using semistructured in-depth phone interviews. Quantitative data will be analysed using regression modelling and qualitative data will be analysed using interpretive phenomenological analysis.

Ethics and dissemination Results will be presented in peer-reviewed journals and at conferences worldwide. This study is approved by hospital and university Human Research Ethics Committees.

Strengths and limitations of this study

- This is a process evaluation of a randomised controlled trial (RCT) representing a broad cohort of older adults recruited from three public metropolitan rehabilitation hospitals in Australia.
- The education intervention delivered in the RCT is being evaluated for its effect on falls rates following hospital discharge. This process evaluation will assess participants' response to the education, which aims to increase older adults' engagement in falls prevention strategies after they are discharged from hospital.
- It will determine if providing falls prevention education can facilitate capability, opportunity and motivation for older adults to engage in falls prevention strategies at home after hospital discharge.
- The prospective design, robust data collection and the convergent embedded mixed-method design uses triangulation to describe the effects of the education on engagement in falls prevention strategies, to outline barriers to engagement and provide a more holistic understanding of the factors that mediate the effectiveness of the education.
- A possible limitation is that the participants have been drawn from a high-risk population that may still be affected by their illness

INTRODUCTION

Globally, falls and falls-related injuries have been identified as a major public health problem associated with population ageing, causing physical injuries including hip fracture, head injury and negatively impacting quality of life among older people.[1–3] In 2015, direct medical costs for fatal falls in the USA have more than tripled since the year 2000,[4] and in Australia the age-standardised falls-related hospitalisations for older adults has continued to increase by 2.3% per year.[5]

Direct costs do not account for the long-term effects of these injuries such as permanent disability, dependence on others and reduced participation in life.[6 7]

Falls are known to be increased among older adults who have been discharged from hospital,[8 9] and it is also known that hospitalisation of older adults, including those who are admitted for acute care and rehabilitation, is associated with decline in function and mobility.[10 11] At least 40% of older adults fall at least once in the 6-month period following hospital discharge, with more than half of falls resulting in an injury.[12 13] This is substantially higher than the annual rate of falls (30%) and injurious falls (10%) reported in the general community.[14]

There is evidence for the effectiveness of exercise and physical activity,[15 16] along with home safety modifications and vitamin D supplementation,[17 18] in reducing falls among older community dwelling adults including those with comorbidities. However, this evidence does not specifically apply to the older postdischarge population. A wide variety of interventions have been evaluated for their efficacy in improving transitions from hospital to home, but these have not focused specifically on falls prevention, and reviews suggest they produce limited positive outcomes and do not significantly reduce adverse events including falls.[19–21]

Older people have been found to have low levels of awareness of their falls risks and the benefits of falls prevention strategies, despite their increased falls risk during the postdischarge period.[22–24] A recent study showed that older people understood and effectively engaged in their discharge plan, yet experienced unanticipated problems, such as difficulty taking medications, uncontrolled pain, poor dietary intake and fragmented social supports, indicating that more support may be required.[25] A pilot randomised controlled trial (RCT) demonstrated that tailored education was received positively by older adults and resulted in increased engagement in falls prevention strategies after discharge,[26] and a recent systematic review found that falls prevention programmes that contained a patient education component were effective in reducing rate of falls after hospital discharge.[27] However, there have been no RCTs to date to show that using patient education alone can reduce falls after discharge. An RCT[28] is the first trial being undertaken to evaluate whether providing tailored falls prevention education, that includes individual health professional consultations in hospital and after discharge in addition to usual care, reduces falls rates in older adults after discharge from hospital. The protocol for the RCT has been published previously.[28]

The education intervention has been developed using the framework of the Capability Opportunity Motivation Behaviour (COM-B) model of health behaviour change.[29] The aim of the education is to increase engagement in falls prevention strategies, therefore it is important to understand the intended effect on this intermediate outcome of engagement in falls prevention strategies. It is yet to be determined if providing tailored falls prevention education can facilitate capability, opportunity and motivation for older adults to engage in falls prevention strategies at home after hospital discharge (figure 1).

STUDY AIMS

The primary aim is to evaluate the impact of tailored falls prevention education provided at hospital discharge in addition to usual care, on older adults' engagement in falls prevention strategies in the 6 months after hospital discharge. This will be compared with those who receive usual care alone. The secondary aims are (A) To evaluate older adults' capability, and motivation, to engage falls prevention strategies for those participants who received tailored falls prevention education in addition to usual care, compared with those that received a social/control intervention in addition to usual care. (B) To identify the opportunity (social and physical environment) surrounding the participant that made the behaviour possible, by exploring the barriers and facilitators identified by older adults to engage in falls prevention strategies in the 6 months following hospital discharge.

METHOD

Design

The study design comprises a process evaluation of an RCT currently being conducted in Perth, Australia.[28] The protocol for the RCT has been previously published.[28] This process evaluation uses a convergent embedded mixed method design;[30] as both quantitative and qualitative data will be collected, analysed, then merged to enrich the interpretation of the results through methodological triangulation. Measuring engagement is a complex concept.[31] By using triangulation to describe the effects of the education on engagement in falls prevention strategies through both quantitative and qualitative data sources, this aims to provide a more holistic understanding of the phenomena.[32 33]

Ethical considerations

Participant information forms are provided at the time of consent at baseline in hospital as a part of the RCT and all participants will provide written informed consent to participate in the study.

Patient involvement

Patients were not directly involved in the design of this process evaluation. Participants are informed at enrolment that they can elect to receive a plain language summary of results when the process evaluation is completed, each participant is reminded of this during the final phone call contact with researchers. Participants will be acknowledged and thanked for their contributions during the publication and distribution of results.

Setting and participants

The setting and participants for the RCT have been described in full previously.[28] Briefly, participants (n=390)

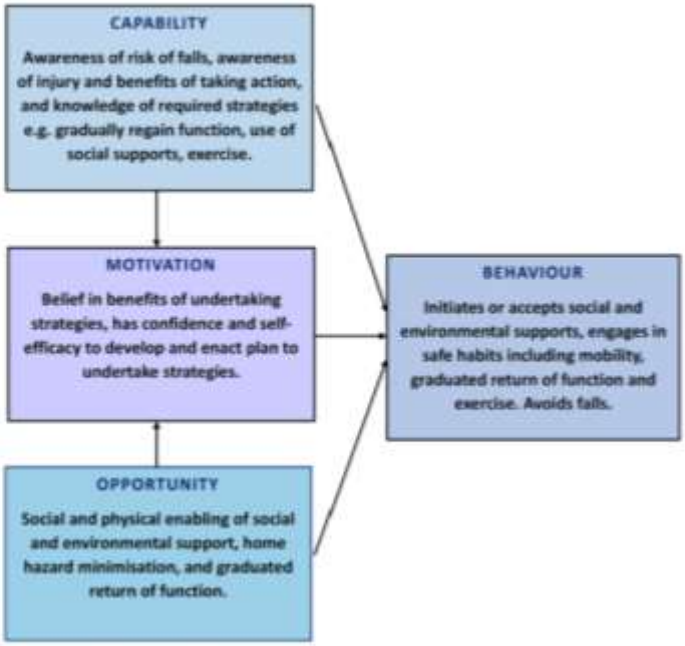

Figure 1 The Capability Opportunity Motivation Behaviour system applied to falls prevention behaviour postdischarge.

are recruited in hospital,[29] provide written informed consent and are then randomly assigned (concealed) to either the intervention group or the control group prior to discharge from aged care rehabilitation and stroke units at three Western Australian hospitals. These wards admit patients with a variety of diagnoses, such as osteoarthritis, recent stroke, Parkinson's disease, dementia, recent orthopaedic or general surgery, or recovering from a general medical condition.

Inclusion and exclusion criteria

Inclusion criteria for the RCT have been described previously.[29] All participants will contribute data for this process evaluation. Briefly, participants must be 60 years of age or older, and have cognitive function rated >7/10 in the Abbreviated Mental Test Score.[34]

Education intervention

The education intervention, which has been described in full previously,[29] is based on a pedagogically sound programme found to be effective in improving knowledge, confidence and motivation for older patients to engage in falls prevention strategies after hospital discharge.[20] The programme is planned to take between two and four sessions to deliver in an estimated total time of 45 min. The education is delivered by physiotherapists and includes providing written and video materials followed by individualised discussion. The education content is based on the principles of health behaviour change, with messages that include falls prevention strategies tailored for each participant, such as instructions on how to engage in exercise according to their capability, to modify home hazards, to use their walking aid, to return to normal function, and how to seek assistance if required for home tasks or personal care.[28]

The control group receives a social intervention, between one and three sessions (estimated total time of 45 min) with a trained health professional who discusses aspects of positive ageing using a scripted programme, without any falls prevention information.

The intervention is delivered in addition to usual inpatient care, including discharge planning, falls education, home-visits and equipment provision, and addition of social supports.[29]

Outcome measures

Quantitative

Primary outcome: engagement in falls prevention strategies in the 6 months after discharge. Falls prevention strategies measured are those suggested to the participant as a part of the tailored education intervention, which is based on current evidence for falls prevention, provided prior to discharge. Each participant has been encouraged to engage in a falls prevention plan which has been tailored by the delivering therapists. This intervention has been described in full elsewhere.[29] Strategies are defined as:

1. Receiving assistance (both formal and informal assistance) with activities of daily living (ADL). ADL are defined according to the Katz index of Independence in Activities of Daily Living,[35] and include toileting, showering and eating.
2. Receiving assistance with instrumental ADL (IADL). IADL are defined using the Lawton Index,[36] and include home cleaning, shopping and transport.

These two outcomes will be measured using yes/no responses and frequency (days per week and hours of total assistance per week) and type of assistance (whether paid formal services from home care provider or informal family or friends' assistance to the participant).

3. Engagement in exercises, including all types (such as a strength and balance exercise programme, group exercise, swimming, golf, tai chi, walking, dancing), whether a balance component is included, and frequency (hours per week and number of times per week) and where completed such as at home, in a healthcare centre, with or without health provider assistance.
4. Home modifications, such as installation of equipment or rails, or alteration of home layout, including whether assessment was provided by an occupational therapist and the level of assistance obtained to make these modifications.

These primary outcomes will be measured in hospital (baseline) by recruiters for the RCT (who are blinded to group allocation), then measured at 6 months following hospital discharge through a structured phone survey by a trained research assistant who is also blinded to group allocation. These surveys have been modified from previous surveys used in falls prevention trials, including the pilot trial which evaluated these outcomes.[13 26 37]

The secondary quantitative outcome measures are:

1. Participants perceived levels of capability (knowledge and awareness) about falls prevention after discharge, such as awareness of risk of falls, awareness of injury and benefits of engaging falls prevention strategies; measured through a structured phone survey using Likert Scales,[38] at baseline and at 6 months follow-up.
2. Motivation, such as beliefs in benefits of engaging strategies, confidence to engage strategies; develop and enact plans to engage strategies.

These secondary outcomes will be measured alongside the primary outcomes, using the methods described above. Survey items for secondary outcomes will be measured using 5-point Likert Scales,[38] (strongly agree to strongly disagree). Items are based on the domains of COM-B,[29] and modified from previous surveys which have evaluated capability, motivation and confidence regarding falls prevention.[13 26 37]

3. Motivation to engage in exercise will be additionally measured using the Self-Efficacy for Exercise Scale (SEE).[39]

The SEE[39] is a nine items scale that rates older peoples' response to a statement about barriers to exercise (scores range from 0 = not very confident to 10 = very confident; with a total possible score of 90).

Qualitative

The secondary qualitative outcomes relate to opportunity (described as being both social and physical in the COM-B framework),[29] and include both barriers and enablers that participants encounter when seeking to engage in falls prevention strategies. These secondary outcomes will be measured by completing semistructured in-depth phone interviews at the conclusion of the observation period. Questions will be guided by participant responses gained from earlier structured phone interviews, using open-ended questions designed to encourage the participants to reflect on their previous responses. Questions will be framed around barriers and enablers to engaging in falls prevention strategies, graduated return to independence and engaging in exercise. This may be physical opportunity provided by their environment including access and social supports, or cultural milieu including stigmas or fears that dictate older adult decision-making.[29]

Demographic data will be gathered in hospital at baseline by recruiters during a face-to-face interview. These data will include age, gender, diagnosis, length of stay in hospital, history of falls prior to hospitalisation and during hospital stay, presence of visual impairment, presence of hearing impairment, number and type of medications, signs of depression (measured using the Geriatric Depression Scale),[40] and use of walking aids.

Other data are also collected at baseline during the face-to-face interview then again at 6 months after discharge using a structured phone survey. These variables are living situation (home alone, with partner, other situation), level of indoor and outdoor mobility, including any use of walking aids, functional mobility measured using Katz and Lawton's scales,[5 36] and health-related quality of life measured using the Assessment of Quality of Life tool.[41]

Additionally, as part of the education intervention, data are collected regarding the delivery of the programme by the educators. These data include the number of education sessions provided to each intervention group participant, the duration and whether an action plan was completed. These data will also be used during sensitivity analyses, to assist to explain participants' knowledge, motivation and engagement in falls prevention strategies after discharge.

Data collection and procedure

Baseline surveys for primary and secondary outcomes are conducted by a trained research assistant who is blinded to group allocation, then participants are randomly allocated to intervention or control group. The RCT protocol, including randomisation, blinding and the intervention procedure has been described in detail elsewhere.[28] Briefly, participants receive tailored falls prevention education by trained physiotherapist educators during a one-to-one interaction in hospital. The education assists the participant to prepare a tailored plan to

initiate after hospital discharge. The participants are then followed up by phone after discharge by the educators once a month for 3 months, to further assist them to enact their plan, and address any barriers that may have arisen since discharge.

At 6 months following hospital discharge, the structured phone survey will be conducted to collect quantitative follow-up data, after which the participant will be invited to participate in a semistructured in-depth phone interview to collect qualitative data that measure the secondary outcome which explores opportunity (barriers and enablers) to engagement in falls prevention strategies.

Purposive sampling for qualitative data collection will occur after the 6-month period and following completion of primary and secondary quantitative data collection. The sample selected will represent the cohort, with consideration of age, diagnosis, gender, falls history, and whether intervention or control group. Purposive sampling will be finalised and justified by referring to data and theoretical saturation and confirmed through consensus of a second researcher reviewing the transcribed narrative data.[42] A phone interview was selected to collect data, rather than a focus group, or face-to-face interview, as the participants have previously received monthly phone monitoring of falls data from the RCT, so the researcher has established a genuine rapport and reciprocity with the participants.[43] To ensure quality data collection that is sufficient to answer the study aim, the semistructured survey has been piloted to ensure the questions are easily understood and screened for blind spots, bias and potentially sensitive questions.[33] Each interview will be recorded and transcribed verbatim. Additional interviews will be completed as necessary until data saturation has occurred. The researcher will keep a journal to record observations and reflections regarding data collection and procedure.[43]

Statistical analysis

Quantitative data

Quantitative data will be analysed using Stata (Stata Statistical Software, StataCorp, College Station, Texas ,USA)[44] and intention-to-treat analysis will be undertaken when examining potential influence of group allocation on process outcomes based on the trial randomisation.[45] Primary and secondary outcomes will be summarised using descriptive statistics. The primary analysis will compare engagement with each strategy between the control and intervention groups for 6 months postdischarge from hospital, using regression models that will control for baseline measures of engagement and be conducted with adjustment for potential covariates consistent with the prior pilot study for this trial.[26] Similarly, secondary analyses will compare the secondary outcomes to examine potential between-group differences using regression models that will control for baseline and be conducted with adjustment for potential covariates consistent with the prior pilot study for this trial.[26] Sensitivity analyses will also be conducted to examine whether the trial findings are robust to planned analysis choices (eg, intention-to-treat versus as-treated analyses, or adjusted versus unadjusted regression models). The significance level for analyses will be set at 0.05, and the sample size was determined by primary trial effect analysis, which has previously been described.[29]

Qualitative data

Qualitative data from researcher field notes, phone interview transcriptions and participant open-ended answers to structured questions in the quantitative survey will be used, with the intent to triangulate the different data sources and gain a multilayered understanding of the findings.[32 33] Interpretive phenomenological analysis (IPA) will be used to describe and interpret participants' behaviours regarding engagement in falls prevention strategies.[46] Briefly, following IPA guidelines the two researchers will independently produce detailed interpretive coding of how and why the participants experienced barriers or enablers to engaging falls prevention strategies since hospital discharge. These coded data will then be examined by the two researchers together to identify emergent themes then re-examined to ascertain if it described the data collected and if all coded data were captured within these identified emergent themes.[46] Member checking will occur by the first researcher returning to a sample of participants to ask them how accurately their realities have been represented in the final interpretations.[42] To add rigour, a third researcher who is not involved in data collection, will then be invited to scrutinise the data and to arbitrate any differences between coding and themes, and review final interpretations.[46] Purposive sampling for qualitative data collection will be finalised and justified by consensus between all three researchers referring to the findings to confirm saturation of themes.[46]

Finally, quantitative and qualitative data will be synthesised to enrich the interpretation of the findings with the aim of adding validity to the study.[33 42] An overview of the procedure for primary and secondary quantitative and qualitative data collection and statistical analysis is presented in figure 2.

DISCUSSION

Older people are known to have increased rates of falls and functional decline following hospital discharge.[7 8] Recent studies investigating readmissions have found that patients are unprepared to manage their physical limitations during their immediate recovery after hospital discharge.[24 25] These investigations have shifted from a hospital-centric model to a patient-centred approach to understand the lived experience of older adults as they transition from hospital to home.[47] This is important because other systematic reviews of discharge planning have identified that while readmissions may be reduced with such interventions, the impact on health outcomes for the patients is uncertain.[48]

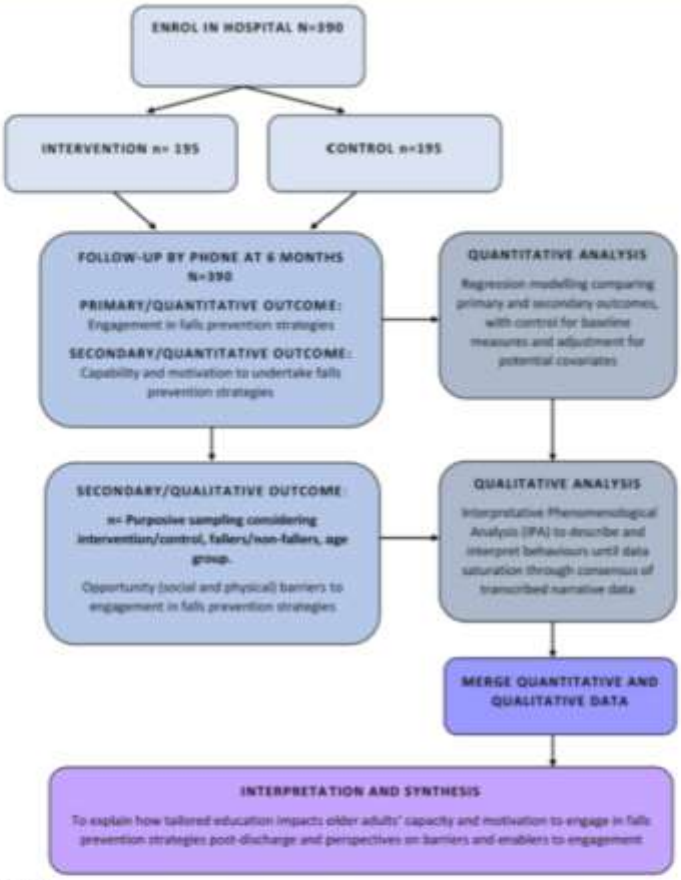

Figure 2 Study procedure

Previous observational studies have suggested that to promote participation in evidenced-based falls prevention strategies, therapists may need to convince older adults that they are at risk of falls,[28] with guidance on what specific strategies are likely to have a personally beneficial falls prevention effect.[22] Tailored health education aims to change individuals' health behaviours.[29 30] When this education is used as an intervention, it presents a challenge for identifying effective components, and therefore reporting of findings, and subsequent replication.[31 32]

This process evaluation will seek to understand whether providing tailored education facilitates older adults' engagement in falls prevention strategies following hospital discharge. The application of the framework of the COM-B model to the findings,[29] will assist to characterise how the intervention altered motivation, capability or opportunity. Additionally, secondary analysis of barriers or enablers to engagement will be mapped onto the COM-B model and subsequently identify more precise determinants of engagement.[29] Capability includes an individual's psychological and physical capacity to engage in falls prevention strategies behaviour. Opportunity, both social and physical, includes those factors that lie outside the individual that make the behaviour possible, such as being able to access home assistance or modifications.[29] Motivation includes all processes that inspire and direct behaviour, such as believing that it would be good to exercise.[29]

This study has strengths and limitations that warrant consideration. A strength is that the participants are a broad cohort recruited from a representative sample of three public metropolitan rehabilitation hospitals in Australia. The delivery of a falls prevention education intervention just prior to discharge with follow-up sessions by telephone during 1 month after hospital discharge has previously shown promising effects on older adult

engagement in falls prevention strategies in a pilot trial.[25] Other strengths include the prospective design, robust data collection and the convergent embedded mixed-method design, which combines the advantages of both quantitative and qualitative data.[32 43]

A possible limitation is that the participants have been drawn from a high-risk population that may still be affected by their illness. To minimise bias through possible prompting of participants, data regarding engagement in falls prevention strategies following hospital discharge, will not be collected until 6 months postdischarge. We are also relying on self-reported data at 6 months. Participants are only contacted by phone and not interviewed face to face, however we have found in our earlier trials[19,26] that this allows more complete responses as older people, especially if unwell, are not always able to attend a clinic setting.

CONCLUSION

This process evaluation will assess older adults' response to a tailored falls prevention education programme and investigate how the intervention was received and interpreted by the older participant during their postdischarge recovery. When delivering interventions that seek to facilitate health behaviour change, it is also important to understand the process by which behaviour changes and the mediating factors.[50 51] This provides evidence to develop a sound basis for defining effective intervention components.[52] We will clarify whether providing tailored falls prevention education can positively change health behaviour. We will also explore older adults' knowledge of falls prevention strategies and motivation to engage falls prevention strategies following hospital discharge. Findings will enable generation of robust recommendations for clinicians and researchers about the role of tailored falls prevention education at the point of hospital discharge. Ultimately, we aim to understand if providing older adults with tailored education enables them to change their health behaviour in the postdischarge period and if engagement in relevant strategies reduces falls after hospital discharge.

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APPENDIX D

Systematic Review Search Strategy usingPubMed key words

Search	Key word		Key word		Key word
1.	accidental fall	AND	older	AND	post-hospital
2.			age*		post-hospital
3.			older		hospital discharge
4.			age*		hospital discharge
5.			older		after hospital
6.			age*		after hospital
7.	fall*	AND	older	AND	post-hospital
8.			age*		post-hospital
9.			older		hospital discharge
10.			age*		hospital discharge
11.			older		after hospital
12.			age*		after hospital
13.	intervention*	AND	older	AND	post-hospital
14.			age*		post-hospital
15.			older		hospital discharge
16.			age*		hospital discharge
17.			older		after hospital
18.			age*		after hospital
19.	prevent*	AND	older	AND	post-hospital
20.			age*		post-hospital
21.			older		hospital discharge
22.			age*		hospital discharge
23.					after hospital
24.					after hospital

APPENDIX E JBI MAStARI Review Instrument

JBI Data Extraction Form for Experimental / Observational Studies

Reviewer ..... Date .....

Author ..... Year .....

Journal ..... Record Number .....

Study Method

RCT ☐ Quasi-RCT ☐ Longitudinal ☐

Retrospective ☐ Observational ☐ Other ☐

Participants

Setting _____

Population _____

Sample size

Group A _____ Group B _____

Interventions

Intervention A _____

_____

Intervention B _____

_____

Authors Conclusions:

_____

_____

_____

Reviewers Conclusions:

_____

_____

_____

JBI Critical Appraisal Checklist for Randomised Control / Pseudo-randomised Trial

Reviewer ..... Date .....

Author ..... Year ..... Record Number .....

	Yes	No	Unclear	Not Applicable
1. Was the assignment to treatment groups truly random?	☐	☐	☐	☐
2. Were participants blinded to treatment allocation?	☐	☐	☐	☐
3. Was allocation to treatment groups concealed from the allocator?	☐	☐	☐	☐
4. Were the outcomes of people who withdrew described and included in the analysis?	☐	☐	☐	☐
5. Were those assessing outcomes blind to the treatment allocation?	☐	☐	☐	☐
6. Were the control and treatment groups comparable at entry?	☐	☐	☐	☐
7. Were groups treated identically other than for the named interventions	☐	☐	☐	☐
8. Were outcomes measured in the same way for all groups?	☐	☐	☐	☐
9. Were outcomes measured in a reliable way?	☐	☐	☐	☐
10. Was appropriate statistical analysis used?	☐	☐	☐	☐
	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info. ☐

Comments (Including reason for exclusion)

APPENDIX F Structured survey

Note: if this is the 6-month call remember to first ask about falls, using the usual monthly questions, then ask participant if they are willing to do the final survey now or when they would like you to ring back.

Participant number _____ Date today _____

1. Call participant between 9 am and 5 30pm. Check if time (15min to talk now) is suitable make arrangement to call back as necessary.
2. First measure Outcome Measures as per attached document (Lawtons, Katz, Aquol - these should appear in spreadsheet first)
3. Second - Ask participant following Qs as below

1). Living situation

1. Community at home alone,
2. Community at home with partner,
3. Community at home with other,
4. Other: specify eg (if moved to care)

2). Re-admission to hospital in the 6 months after discharge for any reason (note this will be captured with falls data record sheet but may not have captured all non-fall admissions)

0 No,
1. Yes

3). If yes Number of days – record……(note;one data entry per admission)

4). Indoor mobility at present

0. No Aid
1. Walking stick
2. Walking frame
3. Wheelchair
4. Unable to mobilize without assistance

Perception of falls

5). Tell me how much you agree or disagree with the following statement: "I think that older people are at risk of falling over during the 6 months after hospital discharge." You can answer.

1 Strongly agree 2Agree 3Undecided 4Disagree
5 Strongly Disagree

6). Tell me how much you agree or disagree with the following statement: "I think that I would be likely to fall over during the next 6 months." You can answer; (Clarify if pt responds DISAGREE – they may have originally AGREED then implemented falls prevention measures as a result…)

1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree

7). I think that if I were to fall over in the next 6 months, I would be likely to get an injury (for example, a cut, a bruise or even a broken bone).

1 Strongly agree 2 Agree 3 Undecided 4 Disagree 5 Strongly disagree

8). Tell me how much you agree or disagree with the following statement: "I think that I have reduced my risk of falls during the past 6 months." You can answer

1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree

9). Tell me how much you agree or disagree with the following statement: "I am confident that I can complete falls prevention activities in the next 6 months." You can answer

1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly disagree

Engagement in Strategies for preventing falls
Answer the following questions regarding what you did since you came home from hospital (in the month since you were discharged)

Activities of daily living

10). Do you get any informal assistance at home with your showering and personal care?
0. No
1. Yes
10a). If yes, who assists you? [Informal ADL]
0. Family in home assist
1. Other in-home assist
2. Both
10b). If yes, how many times per week do you have assistance? [Informal ADL]
0. <3 times per week
1. >3 times per week
2. Daily
11). Do you get any formal assistance at home with your showering and personal care?
0. No
1. Yes
11a). If yes, who assists you? [Formal ADL]
0. Silverchain
1. Bethanie
2. Local council
3. Other
11b). If yes, how many times per week do you have assistance? [Formal ADL]
0. <3 times per week
1. >3 times per week

2. Daily
12). Do you get any informal assistance at home with things like shopping, cleaning and transport (Informal IADL)?
0. No
1. Yes
12a). If yes, who assists you? [IADL]
0. Family in home assist
1. Other in-home assist
2. Both
12b). If yes, how many times per week do you have assistance? [Informal IADL]
0. <3 times per week
1. >3 times per week
2. Daily
13). Do you get any formal assistance at home with things like shopping, cleaning and transport? (Formal IADL)
0. Yes
1. No
13a). If yes, who assists you? (Formal IADL]
0. Silverchain
1. Bethanie
2. Local council
3. Other
13b). If yes, how many times per week do you have assistance? [Formal IADL]
0. <3 times per week
1. >3 times per week
2. Daily
Home Visit
14). In the six months after discharge have you received a visit from an HCP (such as an OT) for a home assessment with follow up modifications?
0. No
1. No but have arranged such a visit
2. Yes, and have modifications in place
3. Yes, and intend to make suggested modifications
4. Yes, and do not intend to make suggested modifications
14a). If Yes 1 or 2:
0. Inside from OT visit
1. Outside from OT visit
2. In and out from OT visit
14b). If Yes 4 ask reason record verbatim.
15). In the month after discharge have you made any modifications to your home that you think will reduce your risk of falling?
0. No
1. Yes, have modifications in place
2. Yes, and plan to make more modifications
15a). If yes – check if done more than 1 thing…
0. Reduced clutter -self
1. Reduced clutter -family assist
2. Removed excess items eg mats
3. Bought new items that promote safety eg shower chair or non-slip mats, lighting

Returning to normal activities
Regarding planning your return to doing any of your usual activities in the six months after discharge:
16). Have you returned to a normal activity gradually by?
0. Picking a good time of day to start this activity
1. Preparing the environment to perform this activity
2. Getting some assistance to perform this activity

Exercises
17). In the six months since discharge have you done exercises
0. No Xs
1. In home with HCP
2. At centre with HCP
3. At centre self/ e.g. gym
4. Tai Chi group
5. Dancing class
6. Own program
7. Swimming
8. Golf
9. Walking
10. Other (specify)
17a). If No but planning to do so – when and what needs to be organised for you to start (add here also if medical barrier) describe verbatim
17b). If yes responses 2 to 7: open response describe using data entry codes. (how many times per week, hours,)

Other
18). In the past 6 months have you had an appointment for a falls clinic assessment?
0. No
1. No but have made the appointment
2. Yes
19). Discussed falls prevention, including dizziness and /or medication alterations, with your GP?
0. No
1. No but have made the appointment
2. Yes, no changes
3. Yes, and some modifications made to medications
19a). If yes record verbatim.

20). Done another activity designed to reduce your risk of falling and safely increase your independence?
0. No
1. Yes
20a). If yes record verbatim.

Medications
21). Including ALL medication prescribed by your doctor, do you take more than 4 tablets a day?
0. No

1. Yes
22). In the PAST WEEK have you taken any medication for your mental well-being?
0. No
1. Yes
23). What medications do you take for your mental well-being?
1. Sleeping tables 2. Tablets for anxiety 3.Tranquillizers 4. Anti-depressants 5. Mood stabilizers 6. Other (specify)

******CHECK IF PARTICIPANT IN CONTROL OR INTERVENTION******
Finally, Regarding education
24). Can you remember being told that you should do exercise to improve your balance and strength by anyone other than the researchers either while you were in hospital or after you left. (Clarify not by people in the research team, but others such as your GP or a physio or a nurse)
0. No. don't recall.
1. Yes.
24a). If Yes, who record verbatim.
25). Can you remember being told that you should do falls prevention activities by anyone other than the researchers either while you were in hospital or after you left.
0. No. don't recall.
1. Yes.
25a). If Yes, who record verbatim
Discharge survey for intervention group participants
26). Did you receive education (clarify-Book/DVD/speaking with educator) from researchers in hospital and three phone calls after discharge by (by Trish, Heather, Lynn or Dani)? If No go to Question 32>>
If Yes:
27). This education made me feel more knowledgeable about preventing falls at home and safely regaining my independence after I return home from hospital.
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree
28). This education made me feel more confident about preventing falls at home and safely regaining my independence after I return home from hospital.
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree
29). This education made me feel more motivated about preventing falls at home and safely regaining my independence after I return home from hospital.
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree
30). I think older people should receive ongoing education about preventing falls at home and safely regaining independence after they return home from hospital.
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree
31). Do you have any suggestions about providing this education to older people, so they are ready to have a safe recovery after discharge?
Open response – record verbatim.

****For both Intervention and Control participants:

Thinking about the past 6 months since you returned home from hospital please respond to the following statements: (give participant information about Likert Scale)

32). I feel I had enough information about how to prevent falls after I returned home from hospital. (C)
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree

33). One or more pieces of information I used to reduce my risk of falls was: Open response (C)
34). I felt I could do the things I needed to do to avoid falling after I returned home from hospital. (O)
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree
35). Can you give me an example what made it difficult to do what you needed to avoid falling? (O)
36). I felt motivated to take action to prevent falls after I returned home from hospital. (M)
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree
37). I feel I had enough information about how to regain my independence after I returned home from hospital. (C)
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree
38). One or more pieces of information I used to regain my independence was: Open response (C)
39). I felt I could do the things I needed to do to regain my independence after I returned home from hospital. (O)
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree
40). Can you give me an example what made it difficult to do what you needed to regain your independence? (O)
41). I felt motivated to take action to regain my independence after I returned home from hospital. M)
1 Strongly agree 2 Agree 3 Undecided 4 Disagree
5 Strongly Disagree

APPENDIX G Semi-structured survey

Prior to the interview:

- *sensitivity to context needs to be established through data already obtained, including if participant received the intervention, date of discharge, falls data, re-admissions, falls strategies and any reflections.*
- *Confirm verbal consent to record phone interview*

Throughout the interview:

- *Member-check with participant by repeating/rephrasing main points of their responses to enable confirmation, clarification and stimulate more detail; nuance, opposing views.*
- *ID of barriers and enablers to recovery, falls prevention, independence, exercise; any reference to the fall education/intervention throughout the conversation*
- *influences of the intervention, of the health system, of others and of self*
- *emotions*

Record reflections of the interview once completed.

1. Looking back since you were in hospital over 6 months ago, what is important to you now in terms of managing your everyday life?

2. Are there any elements about your transition from hospital to home that you would like to tell me about? Difficulties? Factors that made the transition easier?
3. How prepared were you for the possibility of falling when you came home from hospital?
4. What made it difficult?
5. What made it easier?
6. What kind of things are you doing now to remain as independent as possible at home? Difficulties? Enablers?
7. You did/did not have any assistance with your ADLs or IADLs, what made it easier for you to get the assistance. What made it difficult?
8. You mentioned that you exercise/don't exercise when we last spoke. What made it easier for you to exercise since your discharge home? What made it difficult? Was there anything that could have been done to make it easier?
9. You have/have no home modifications (such as rails/equip or decluttering) when we last spoke. What made it easier for you to have these modifications completed? What made it difficult?

END OF THESIS