

A balance-training exercise programme for community-dwelling rural older people: Evaluation by a mixed methods design

Karyn Blackman
B.AppSc(Physio)
M.MusSkelStud(ManTher)

Thesis submitted in fulfilment of the requirements for the degree of Doctor
of Philosophy

The University of Newcastle
New South Wales

October 2011

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library**, being made available for loan and photocopying subject to the provisions of the Copyright Act 1968.

**Unless an Embargo has been approved for a determined period.

Karyn Blackman

Acknowledgements

I would like to offer my sincere thanks to the many people who supported me in this research. I begin my paying special tribute to my husband Sean, for his enduring support, patience and encouragement during this and many other endeavours.

I wish to express my gratitude to my supervisors. Dr Catherine Sherrington generously and enthusiastically provided support and guidance throughout all stages, from conception of the research idea to completion. Dr Susan Ryan gave graciously of her time and expertise. Susan's dedication and empathy were an encouragement and inspiration. Professors Darren Rivett and Peter Jones offered valuable advice regarding study design and comments on thesis drafts.

My sincere thanks go to Peter Cryer for his patience and dedication in conducting participant assessments and the long hours of travel entailed. I would like to acknowledge the invaluable contribution of those physiotherapists who instructed exercise classes and shared their experience at interview; Suzie Bilsborough, Nicole Connor, Elizabeth Wellard and Dianne Whitten. Thanks also to the volunteer assistants who helped at classes and offered insightful comments on the programme.

I wish to thank the study participants who gave generously of their time and acknowledge the Australian Physiotherapy Association and NSW Physiotherapists Registration Board for awarding scholarships towards this research.

Finally, I would like to offer special thanks to my parents, Paul and Helen Blackman, for their commitment to and ongoing support of my education, from elementary to post graduate levels. Yours is a true gift.

Presentations

Aspects of this research have been presented at the followings conferences:

Blackman KR. An evidence-based approach to designing a rural fall prevention programme. The Third Annual NSW Primary Health Care Research and Evaluation Conference, Sydney December 1-2 2005. (Oral)

Blackman KR. Rural interventions to prevent falls in the elderly: A review of the evidence. The Australian Association of Gerontology (NSW Division) Rural Conference. Positive Ageing: Something to Sing About, Tamworth March 24-25 2006. (Oral)

Blackman KR, Sherrington C, Rivett DA, Jones PD. Launching a Fall Prevention Programme in Rural Northern NSW. Australian Falls Prevention Conference, Brisbane November 5-7 2006. (Poster)

Blackman KR, Sherrington C, Rivett DA, Jones PD. Fit and Free: An exercise programme to reduce fall risk in communities of northern NSW. Australian Rural Health Research Colloquium, Tamworth May 15-16 2007. (Oral)

Blackman KR, Sherrington C, Rivett DA, Jones PD. Evidence into practice: Fall prevention exercise programmes in a rural context. Australian Rural Health Research Colloquium, Tamworth May 15-16 2007. (Poster)

Blackman KR, Sherrington C, Rivett DA, Jones PD. The development of a fall prevention exercise programme in rural northern NSW. General Practice and Primary Health Care Research Conference, Sydney May 23-25 2007. (Poster)

Blackman KR, Sherrington C, Rivett DA, Jones PD. A balance retraining exercise programme for community-dwelling rural older people: Evaluation by a mixed methods design. 3rd Australian and New Zealand Falls Prevention Conference, Melbourne October 12-14 2008. (Oral)

Blackman KR, Sherrington C, Rivett DA, Jones PD. 'Fit and Free': Lessons from a rural exercise trial. 41st Australian Association of Gerontology National Conference, Perth November 18-21 2008. (Oral)

Blackman KR, Sherrington C, Rivett DA, Jones PD. 'Fit and Free': A fall prevention exercise programme for community-dwelling rural elders. The Australian Physiotherapy Association Conference Week, Sydney October 1-5 2009. (Oral)

Table of Contents

CHAPTER 1: Introduction	1
CHAPTER 2: Preventing falls in the rural setting.....	6
2.1 Introduction	6
2.2 The problem of falls	6
2.3 Risk factors for falling.....	8
2.4 Interventions to prevent falls.....	9
2.5 Exercise interventions to prevent falls	11
2.5.1 Type of exercise.....	13
2.5.2 Exercise dose	14
2.5.3 Supervision	14
2.5.4 Group exercise vs. individual programme	14
2.5.5 Issues with translating innovations into practice	15
2.5.6 Building capacity	19
2.6 Rural healthcare	19
2.6.1 The issue of access.....	20
2.6.2 The rural workforce	20
2.7 Interventions to prevent falls among rural older people.....	23
2.7.1 Multi-component interventions.....	29
2.7.2 Single interventions	29
2.7.3 Lessons from rural fall prevention interventions	30
2.8 Summary	30
CHAPTER 3: Exercise and age considerations in fall prevention	32
3.1 Introduction	32
3.2 Quality of life	32
3.2.1 Defining and measuring QOL.....	32
3.2.2 Older people's views of successful ageing and QOL	33
3.2.3 Physical activity and QOL	34
3.2.4 Impacts of fall prevention interventions on QOL	36
3.3 Self-efficacy	37
3.3.1 Efficacy building strategies.....	41
3.3.2 Measurement of self-efficacy	43
3.4 Adherence	43
3.4.1 Facilitators and barriers to participation in fall prevention programmes	44
3.4.2 Ongoing participation	47
3.5 Summary	47

CHAPTER 4: Mixed methods research	49
4.1 Introduction.....	49
4.2 Mixed methods research	49
4.2.1 Tracing the history of mixed methods.....	49
4.2.2 Strengths of mixed methods research.....	50
4.2.3 Limitations of mixed methods research	50
4.2.4 Mixed methods in the health sciences	51
4.2.5 Mixed methods in evaluation contexts	51
4.3 Summary	51
CHAPTER 5: The Methodology and research design	54
5.1 Introduction.....	54
5.2 Application of mixed methods to the study	54
5.2.1 Reasons for using mixed methods	54
5.2.2 The embedded experimental model.....	55
5.2.3 Priority.....	57
5.2.4 Implementation of the methods	57
5.2.5 Integration	57
5.2.6 A pragmatic approach	57
5.3 Overview of the study.....	58
5.4 Study setting	60
5.4.1 Selection of the study sites	60
5.4.2 Site demographic and socioeconomic characteristics	61
5.5 Participants	63
5.5.1 Inclusion/exclusion criteria	63
5.5.2 Recruitment	64
5.6 Implementation of the study	64
5.6.1 Ethics	68
5.6.2 Staffing and researcher roles in the study.....	68
5.6.3 Co-ordination of the project	68
5.6.4 The volunteer assistants.....	69
5.6.5 Storage, access and disposal of data.....	69
5.6.6 The researcher's background and position	70
5.7 Summary	70
CHAPTER 6: Methods of the randomised controlled trial	71
6.1 Introduction.....	71
6.2 The Randomised Controlled Trial design	71
6.2.1 Sample size calculations.....	72

6.2.2	Randomisation	72
6.3	The intervention	73
6.3.1	Exercise prescription.....	73
6.3.2	The exercise class	74
6.3.3	The home exercise programme	74
6.3.4	Equipment.....	75
6.3.5	The basic exercises	76
6.3.6	Social aspects of the program	82
6.3.7	The fall prevention booklet.....	82
6.3.8	Background information	82
6.3.9	Measures of adherence to the intervention	83
6.4	Outcome measures	83
6.4.1	Primary outcome measures.....	84
6.4.2	Secondary outcome measures	86
6.4.3	Adverse events.....	96
6.4.4	Falls.....	96
6.5	Data management and analysis	97
CHAPTER 7: Methods of the embedded qualitative study		99
7.1	Introduction.....	99
7.2	Data generation and management	99
7.2.1	The rationale for using grounded theory as a qualitative method.....	99
7.2.2	Rationale for using interviews	100
7.2.3	Design of the interview schedule.....	101
7.2.4	The interviews.....	103
7.2.5	Data management	103
7.3	Method of data analysis and interpretation	104
7.3.1	Sampling procedure	104
7.3.2	The data analysis process.....	104
7.4	The research process and rigour.....	106
7.4.1	Coding.....	106
7.4.2	Audit trail	107
7.4.3	Use of software	108
7.4.4	Saturation	108
7.4.5	Discrepant cases.....	109
7.4.6	Member checking	109
7.4.7	Reflexivity	110
7.4.8	Triangulation.....	110

7.4.9	Comparing with the literature.....	111
7.5	Transferability.....	111
7.6	Summary.....	111
CHAPTER 8: Results of the randomised controlled trial		113
8.1	Baseline participant characteristics.....	113
8.2	Completion rates.....	123
8.2.1	RCT design and randomisation	123
8.2.2	Follow-up assessments	124
8.2.3	Self-report calendars.....	124
8.2.4	Home programme compliance	124
8.2.5	Attendance.....	125
8.3	Primary outcome measures	126
8.3.1	Composite PPA falls risk score	126
8.3.2	Berg Balance Scale total score	127
8.4	Secondary outcome measures.....	128
8.4.1	PPA and Berg Balance Scale component tests.....	128
8.4.2	Additional physical tests.....	130
8.4.3	Activities of daily living and psychosocial questionnaires.....	131
8.4.4	Occasions of general exercise	131
8.4.5	Falls	133
8.5	Adverse events.....	135
8.6	Comparison between study sites.....	136
8.7	Summary of the findings.....	139
CHAPTER 9: Findings of the embedded qualitative study		140
9.1	Key concept: Confidence and motivation.....	140
9.1.1	Theme one: Group exercise.....	141
9.1.2	Theme two: The type of exercise	147
9.1.3	Theme three: Delivery format	151
9.2	Key concept: Enhanced Quality of Life (QOL).....	154
9.2.1	Theme one: Enhanced physical function.....	155
9.2.2	Theme two: Enhanced social function	157
9.2.3	Theme three: Enhanced mental health.....	161
9.3	Key concept: Factors in programme implementation.....	168
9.3.1	Theme: Barriers to delivery.....	169
9.3.2	Theme: Facilitators to programme delivery – delivery format.....	170
9.3.3	Capacity building	174
9.3.4	Acceptability	176

9.4	The starting grounded theory	177
9.5	Summary	180
CHAPTER 10: Discussion and conclusion		181
10.1	Introduction	181
10.2	Overarching summary of the findings.....	181
10.3	Preventing falls in rural contexts.....	182
10.4	Effectiveness of the intervention.....	183
10.5	Study design issues	185
10.5.1	The mixed methods design	185
10.5.2	The RCT design.....	186
10.6	Process and outcomes	188
10.6.1	Quality of life	188
10.6.2	Building self-efficacy	191
10.6.3	Enhancing adherence.....	195
10.6.4	Implementation.....	198
10.7	Conclusion.....	203

Table of Figures

Figure 5-1: Model of the overall study.	56
Figure 5-2: Map showing the location of the HNEAHS within NSW and the study sites within the HNEAHS	60
Figure 5-3: Phase structure	66
Figure 5-4: Schedule of phases	67
Figure 6-1: Campbell and Stanley's true experimental design	71
Figure 6-2: Depoy and Gitlin's version of the experimental design	72
Figure 6-3: Stepping forwards onto a block.....	76
Figure 6-4: Stepping sideways onto a block	77
Figure 6-5: Stepping forward.....	77
Figure 6-6: Stepping in different directions	78
Figure 6-7: a) Semi-tandem stance, b) tandem stance, and c) tandem standing on a line.....	79
Figure 6-8: Tandem walking.....	79
Figure 6-9: Walking over obstacles	80
Figure 6-10: Sitting to standing	80
Figure 6-11: Knee bends.....	81
Figure 6-12: Heel raises	81
Figure 6-13: Reaching.....	82

Figure 6-14: Falls risk score by age (Lord, Menz et al., 2003)	85
Figure 6-15: Knee extension strength testing	87
Figure 6-16: Finger press reaction time testing	87
Figure 6-17: Contrast sensitivity testing.....	88
Figure 6-18: Test for proprioception	88
Figure 6-19: Tests of standing balance.....	89
Figure 6-20: Example sway traces. Anticlockwise from top left: 1. eyes open stand on floor, 2. eyes closed stand on floor, 3. eyes open stand on foam, 4. eyes closed stand on foam .	90
Figure 6-21: Maximal balance range testing	91
Figure 6-22: Example trace	91
Figure 6-23: Coordinated stability test	92
Figure 6-24: Example trace	92
Figure 6-25: Placement of panels on the portable CSRT mat	93
Figure 8-1: Number of health problems by percent of sample (n = 147)	114
Figure 8-2: Number of medications used (n = 147)	115
Figure 8-3: Participant flow through the RCT.....	123
Figure 8-4: Mean weekly occasions of home programme for the intervention group (error bars represent 95% CI).....	125
Figure 8-5: Change in PPA composite scores (mean) from baseline to post intervention (error bars = 95% CI)	126
Figure 8-6: Relationships between post intervention Berg Balance Scale total score and baseline values for control (+) and intervention (○) groups. Lines represent post intervention score regressed against baseline score for control group (dashed line) and post intervention score regressed against baseline score for intervention group (solid line)	127
Figure 8-7: Relationships between post intervention sway distance eyes closed (mm) and baseline values for control (+) and intervention (○) groups. Lines represent post intervention score regressed against baseline score for control group (dashed line) and post intervention score regressed against baseline score for intervention group (solid line).....	129
Figure 8-8: Relationships between post intervention CSRT (seconds) and baseline values for control (+) and intervention (○) groups. Lines represent post intervention score regressed against baseline score for control group (dashed line) and post intervention score regressed against baseline score for intervention group (solid line)	130
Figure 8-9: Mean weekly occasions of general exercise for control (□) and intervention (■) groups (error bars represent 95% CI)	132
Figure 8-10: Weekly occasions of general exercise (■) and home programme (□) for the intervention group (mean, error bars represent 95% CI).....	132

Figure 8-11: Mean falls per month for control (□) and intervention groups (■) (error bars represent 95% CI)	135
Figure 9-1: Concept - Confidence and motivation.....	141
Figure 9-2: Concept - Enhanced Quality of Life	154
Figure 9-3: Concept - Factors in programme implementation.....	169
Figure 9-4: A starting grounded theory of the intervention: Processes and outcomes	179

Table of Tables

Table 2-1: Characteristics of ‘successful’ individual and group exercise interventions for community dwellers in RCTs	12
Table 2-2: Rural multi-component interventions to reduce risk of falls or falls.....	25
Table 2-3: Rural single interventions to reduce risk of falls or falls.....	27
Table 5-1: An overview of the research framework	59
Table 5-2: Demographic characteristics of the study sites.....	62
Table 8-1: Summary of demographic characteristics.....	113
Table 8-2: Age subgroups (%).....	114
Table 8-3: Number of participants on one or more medication in each therapeutic class (%) .	115
Table 8-4: Living circumstances (%).....	116
Table 8-5: Sample breakdown by study site	116
Table 8-6: Physiological Profile Assessment results	117
Table 8-7: Berg Balance Scale results	118
Table 8-8: Standing balance and other measures of mobility	119
Table 8-9: Self-reported measures of health and physical activity	120
Table 8-10: Self-reported fear of falling and balance	121
Table 8-11: Self-reported measures of ADL.....	122
Table 8-12: Programme length and attendance.....	126
Table 8-13: Predicted values for baseline Berg Balance Scale total score (T=Treatment, C=Control)	128
Table 8-14: Predicted values for baseline CSRT (seconds) (T=Treatment, C=Control)	131
Table 8-15: Weekly occasions of home exercise (HP) and general exercise.....	133
Table 8-16: Number of falls by group	134
Table 8-17: Demographic characteristics by study site	137
Table 8-18: Primary outcome measures by study site	138
Table 8-19: Summary of 14 week findings.....	139

Abstract

Specifically designed exercise programmes are recognised as an effective intervention to prevent accidental falls among older adults. Because the challenges of providing fall prevention interventions are greater in rural areas, it is likely that rural programmes will require special consideration with respect to design and implementation. Although many studies have investigated fall prevention exercise programmes, relatively few have investigated programmes delivered in a rural context.

This mixed methods study aimed to investigate the effects of a balance-training exercise programme on fall risk factors in 147 community-dwelling rural older adults from five locations across northern New South Wales. The study's secondary purpose was to explore programme processes and outcomes. To achieve these aims, a randomised controlled trial compared the impact of the exercise programme with that of a usual care control group. An embedded qualitative study used semi-structured interviews and a modified grounded theory approach to explore participant and provider experiences and views of the programme.

There were significant improvements in the two primary outcome measures, composite falls risk score (measured by the Physiological Profile Assessment, $p=0.012$) and balance (measured by the Berg Balance Scale, $p=0.043$). There were also significant improvements for the intervention group compared with the control group, in several secondary outcome measures; knee extensor strength, hand reaction time, sway on foam with eyes closed, choice stepping reaction time, and timed stand on one foot.

Qualitative analysis and interpretation indicated that program delivery format, type of exercise and exercising in a group, together with a range of biopsychosocial outcomes had contributed to enhanced quality of life. A starting grounded theory is presented to explain programme processes and outcomes. Despite several identified barriers, specific implementation strategies facilitated the delivery of an effective, feasible and acceptable exercise intervention in Northern New South Wales. It is anticipated that the findings of this study will inform policy, research and clinical practice.

CHAPTER 1: INTRODUCTION

It is widely documented that accidental falls among older adults are a major health issue (Lord, Sherrington, Menz, & Close, 2007a). Community studies reveal that approximately one-third of Australians aged 65 years and older fall at least once a year (Dolinis, Harrison, & Andrews, 1997; Kendig, Helme, & Teshuva, 1996; Lord, Ward, Williams, & Anstey, 1993). Falls result in disability, fear of falling and restriction of activity, all of which can reduce quality of life (QOL) and independence (Hill, Schwarz, Kalogeropoulos, & Gibson, 1996; Makai, Holliday, & Topper, 1991; Tinetti, Mendes de Leon, Doucette, & Baker, 1994). Falls are also the leading cause of injury-related hospitalisation and death among persons aged 65 years and over (Close et al., 1999). In the decades ahead, the proportion of older people in the Australian population is expected to grow (Australian Bureau of Statistics, 2008a). Determining an effective strategy to prevent older people from falling is therefore a matter of importance, not only for reducing the medical costs of an ageing society, but for achieving a higher quality of life in old age (Fukukawa et al., 2008; Ward-Griffin et al., 2004).

Despite a great deal of research into fall prevention interventions, there are still gaps in the evidence. For example, there is good evidence that exercise can modify key fall risk factors such as impaired balance and strength (Buchner, Beresford, Larson, LaCroix, & Wagner, 1992; Lord, Ward, Williams, & Strudwick, 1995) and reduce the incidence of falls (Gillespie et al., 2009; Sherrington, Whitney et al., 2008). However, there is a lack of evidence indicating the relative benefits of various exercise components for optimal fall prevention (Lord, Sherrington, Menz, Close, & Whitney, 2007b; Sherrington, Whitney et al., 2008). Moreover, there is only limited understanding of the processes at work within programmes, including the factors affecting adherence and broader programme outcomes.

Interestingly, while the evidence-base for fall prevention exercise interventions continues to grow, implementation of successful strategies has been slow. Thus, a remaining challenge is to translate existing evidence into clinical practice (Robinson, 2008; Tinetti, 2001). This will require that exercise interventions be implemented into everyday settings, with usual healthcare providers and comparatively limited resources (Elley, 2008; Elley et al., 2006; Wagner et al., 1994).

About one third of Australians live in rural areas (Australian Institute of Health and Welfare, 2008a). Falls are a particular problem in rural Australia, where the ageing population is more

marked (Australian Bureau of Statistics, 2007) and there is reduced access to health services (Australian Institute of Health and Welfare, 2008a, 2008b; Bourke et al., 2004; Larson, 2002; National Rural Health Alliance, 2005).

In general it is argued that local models of healthcare delivery are required to meet the needs of rural communities (Jones, 2008; Sheppard, 2001). However few fall prevention exercise trials have been undertaken in rural settings. Hence research is required to determine which fall prevention programmes and models of implementation will be most effective in rural contexts.

Fall prevention programmes have traditionally been evaluated by quantitative outcomes of physical parameters and rates of falls (Laybourne, Biggs, & Martin, 2008). However, quantitative measures alone may not identify broader programme outcomes. Qualitative methods can enhance understanding of programme processes, and elucidate the range and extent of programme outcomes.

Qualitative methods may also assist understanding of adherence to an intervention. Fall prevention programmes have typically struggled with issues of attrition and non-adherence (Campbell et al., 1997; Day et al., 2002; McInnes & Askie, 2004; Yardley, Donovan-Hall, Francis, & Todd, 2006). Trials to date provide little information on how participants viewed programmes and perceived barriers to taking part (Ballinger & Clemson, 2006; McInnes & Askie, 2004).

The present study sought to evaluate a fall prevention exercise programme implemented into five rural communities across northern New South Wales. The primary aim was to examine the relationship between participation in the exercise programme and measures of fall risk factors. This aspect of the research addressed the question; ‘Will a balance-training exercise programme significantly reduce fall risk factors for community-dwelling rural older people?’ The secondary purpose was to explore programme processes and outcomes. This latter aspect of the research addressed the question; ‘What were the programme’s processes and outcomes?’

To address these research aims, the study used a mixed methods ‘embedded experimental model’, incorporating a Randomised Controlled Trial (RCT) and embedded qualitative study. RCTs are considered the gold standard for evaluating procedures (Boutron et al., 2008). Additionally the qualitative study utilised modified grounded theory to explore participant and provider perspectives. It was intended that using both quantitative and qualitative methods would provide a deeper understand of the programme, thereby adding richness to the research.

Consistent with RCT design, 147 community-dwelling older people were allocated to either a balance-training exercise programme or usual care control group. To explicate programme processes and outcomes, the embedded study explored participants' (n=70), volunteer assistants' (n=17) and physiotherapists' (n=4), views and experiences of the intervention.

This thesis is presented in ten chapters. This first chapter provides an introduction to the present research and the rationale for conducting it. Part A, includes Chapters 2 to 4, and provides a critical review of relevant literature. Chapter 2 gives an overview of the incidence, consequences and costs of falls among older people. It examines intervention approaches to prevent falls and highlights the potential of exercise programmes for reducing fall risk factors and falls. The latter part of Chapter 2 focuses on rural fall prevention programmes, highlighting the need for research into rural fall prevention exercise programmes. Chapter 3 explores the literature on successful ageing, quality of life and self-efficacy with reference to fall prevention interventions. Issues associated with adherence to fall prevention programmes are discussed alongside strategies to promote uptake and retention. Chapter 4 overviews mixed methods research.

Part B includes Chapters 5 to 7, which describe the research methodology. Chapter 5 details the application of a specific mixed methods design to the research. It outlines aspects of the methodology common to both the RCT and embedded study. Chapter 6 explains the methods of the RCT, specifically; trial design, measurement tools and procedures, the intervention programme, and statistical analysis. Chapter 7 shifts the focus to the embedded study. It outlines the rationale for using semi-structured interviews, and describes the development and use of interview schedules. Chapter 7 also discusses the application of a modified grounded theory approach to the embedded study and explains techniques used to enhance the 'rigour' of the embedded study.

Part C presents results and findings of the research in two chapters. Chapter 8 details the results of the RCT, in terms of participant-reported outcome variables and results of the physical assessments. Chapter 9 imparts findings of the embedded study. Key concepts, themes and sub-themes are discussed and example respondent comments provided. Chapter 9 culminates in the presentation of a starting grounded theory which explains the programme processes and outcomes.

The Discussion and Conclusion (Chapter 10) draws together key findings from the RCT and embedded study. Research findings are discussed with reference to the existing literature. A critique of the present research points out limitations and generates suggestions for possible

improvements. In addition, Chapter 10 highlights implications for rural clinical practice and further research.

The thesis Appendix provides additional detail to supplement earlier chapters. Enclosed are copies of the Human Research Ethics Committee approvals, recruitment resources, information statements and consent forms. A range of programme infrastructure resources, including questionnaires and data collection instruments, are provided. The Appendix offers RCT results additional to those detailed in Chapter 8. Lastly, the Appendix presents example nVivo7 (QSR International Doncaster, Australia) files from the embedded study.

Throughout this thesis, and as is the case in most of the literature, the term ‘rural health’ will assume the practice and discipline of remote health (Wakerman & Lenthall, 2002). To remain consistent with recent literature investigating falls in older people, the Prevention of Falls Network Europe (ProFaNE) definition of a fall will be used: “An unexpected event in which the participant comes to rest on the ground, floor or lower level” (Lamb, Jorstad-Stein, Hauer, Becker, & ProFaNE., 2005, p. 1619).

PART A

THE LITERATURE REVIEW

Chapter 2: Preventing Falls in the Rural Setting

Chapter 3: Exercise and Age Considerations in Fall Prevention

Chapter 4: Mixed Methods Research

CHAPTER 2: PREVENTING FALLS IN THE RURAL SETTING

2.1 Introduction

The literature review of this thesis is separated into three chapters. This chapter considers two main topics. Firstly, it outlines the problem of falls in older people, discusses intervention approaches to prevent falls, and considers issues surrounding translation of evidence into practice. Secondly, it focuses on healthcare in a rural context and draws implications for rural fall prevention programmes. Chapter 2 concludes with a discussion and critique of rural fall prevention exercise interventions. Chapter 3 explores age and exercise considerations in fall prevention.

2.2 The problem of falls

Following worldwide trends, the Australian population is ageing, with people 65 years and over expected to make up between 26% and 28% of the population by 2051, compared with 13% in 2004 (Australian Bureau of Statistics, 2008a). Australians currently enjoy the world's second highest life expectancy (80.9 years) (Australian Bureau of Statistics, 2008b) and it is projected that by 2042, life expectancy at birth will increase to 83.9 years for men and 88.5 years for women (Costello, 2002).

Falls are an obstacle to healthy ageing. They are a leading cause of morbidity and mortality for older people (American Geriatrics Society, British Geriatrics Society, & American Academy of Orthopaedic Surgeons Panel on Falls Prevention, 2001; Laybourne et al., 2008). Moreover, falls impose a high cost, in terms of the health expenditure required to treat those who have fallen (Brown, 2004; Campbell & Robertson, 2007; Lord, Sherrington, Menz, & Close, 2007a; Sherrington, Lord, & Finch, 2004; Todd & Skelton, 2004). There is now a significant body of research exploring accidental falls among older people, including demography, risk factors, consequences and interventions to prevent falling. The following section provides an overview of this research.

Australian studies in the 1990s, using a random selection process for recruitment of persons 65 years and older, showed that around 30% reported one or more falls in the previous year (Dolinis et al., 1997; Kendig et al., 1996; Lord et al., 1993). These fall rates were comparable to rates reported in other countries, including the United Kingdom (Prudham & Evans, 1981),

United States of America (Tinetti, Speechley, & Ginter, 1988), and New Zealand (Campbell, Reinken, Allan, & Martinez, 1981).

Of particular concern is the combination of high incidence of falls and high susceptibility to injury among older adults (Rubenstein & Josephson, 2002). Over 30% of fallers, aged 65 years and older, experience injuries requiring medical attention (National Ageing Research Institute, 2004). Moreover, falls constitute a leading cause of injury related hospitalisation for persons aged 65 years and over (Close et al., 1999).

For Australians 65 years and over, the rate of injurious falls requiring hospitalisation in 2007-8 was 2,516 per 100, 000. Rates of hospitalisation due to falls were higher in older women than older men. Fracture, especially hip fracture, was a common consequence of falls among older people. Of the hospitalised fall related injuries for older people in 2007-8, three in ten involved the hip or thigh. Head injuries, as a result of a fall were also common. Deaths following falls rose rapidly with age, especially after around 70 years of age (Australian Institute of Health and Welfare, 2010).

Falls in older people place a heavy burden on the health system because they are numerous and have a long average hospital stay (Bradley & Harrison, 2007; Todd & Skelton, 2004). It has been estimated that the average total hospital stay due to an injurious fall by an older person was 16 days in 2007-8. In 2007-8 the direct cost of fall related acute episodes of care for Australians aged 65 and over was estimated to be \$600 million. However, the total hospital cost is likely to be considerably higher, because some episodes of care, such as rehabilitation, were not included in this estimate (Australian Institute of Health and Welfare, 2010).

Based on current Australian trends, it is projected that the number of hip fracture patients each year will double by 2026, and increase four-fold by 2051. Other fractures associated with falls (e.g. wrist, humerus, pelvic) are anticipated to show a similar proportional increase over coming years (Sanders et al., 1999). In a report prepared for the Australian Government, it has been estimated that if current fall rates continue and the proportion of older people grows as predicted, by 2051 the total cost attributed to fall related injury will increase almost three-fold from current levels to \$1,375 million per annum. An additional 2,500 hospital beds and 3,320 nursing home places will be required for people who have fallen (Moller, 2003) .

In addition to their immediate effects, falls have been associated with fear of falling, loss of confidence, loss of mobility, disability, loss of independence, admission to supported residential care, and premature death (Gates, Fisher, Cooke, Carter, & Lamb, 2008; Rubenstein &

Josephson, 2002; Tinetti, 2004; Tinetti & Williams, 1997, 1998). Chapter 3 of this thesis provides an extended discussion on fear of falling and its consequences. Also of concern is that older people who have fallen are at greater risk of falling again. Nivett, Cummings, Kidd, and Black (1989) conducted a prospective study of 325 community-dwelling persons who had fallen in the previous year. In the 12-month follow-up period, 57% experienced at least one fall and 31% had two or more falls.

Determining an effective strategy to prevent older people from falling is therefore a matter of importance not only for achieving a higher quality of life in old age, but for reducing the medical costs of an ageing society (Fukukawa et al., 2008). To this end, the prevention of fall injuries has been ranked as a national priority and is the subject of both the National Injury Prevention and Safety Promotion Plan: 2004-2014 (National Public Health Partnership, 2005a) and the National Falls Prevention for Older People Plan 2004: Onwards (National Public Health Partnership, 2005b).

Fall prevention approaches are required for community, residential and hospital settings. Each setting is unique and demands specific consideration (National Public Health Partnership, 2005b). The majority (94%) of people aged 65 years and over live in private dwellings in the community (Australian Institute of Health and Welfare, 2007). The National Falls Prevention Plan for Older People: 2004 Onwards (National Public Health Partnership, 2005b, p. 2) recognises that “Australians of all ages value their independence and the opportunity to live at home or in the environment of their choice”. The plan highlights that older people living independently in the community represent the greatest challenge for reducing their risk of falls because of their high degree of autonomy and the extreme diversity of this group. Moreover, the plan emphasises the importance of targeting fall prevention among community-dwellers, so they can enjoy optimal quality of life and continue to live independently.

2.3 Risk factors for falling

Falls among older people are not random events (Sherrington, Whitney et al., 2008). Large epidemiological studies have identified specific risk factors that predispose people to falling (Carter, Kannus, & Khan, 2001; Lord, Sherrington, Menz, & Close, 2007b; McClure et al., 2005; Tinetti, 2001; Todd & Skelton, 2004). These risk factors are diverse, and generally considered to be either intrinsic or extrinsic. Intrinsic risk factors pertain to the physical and cognitive status of the individual. Whereas extrinsic risk factors relate to environmental hazards

or factors affecting the interface between the individual and the environment, such as footwear, assistive devices or spectacles (Close, Lord, Menz, & Sherrington, 2005).

It is recognised that falls generally result from multiple, diverse, and interacting risk factors (American Geriatrics Society et al., 2001; Chang & Ganz, 2007; Rubenstein, Powers, & MacLean, 2001; Todd & Skelton, 2004) and the risk of falling increases as the number of risk factors increases (Robbins et al., 1989; Tinetti, Williams, & Mayewski, 1986). Some risk factors can be modified by exercise (e.g. reduced muscle strength, impaired balance and gait), some require other intervention approaches (e.g. poor vision and psychoactive medication use) and others are not able to be modified (e.g. age and gender) (American Geriatrics Society et al., 2001; Sherrington, Whitney et al., 2008).

Impaired balance and mobility has been identified as one of the strongest risk factor domains for falls (Lord, Sherrington, Menz, Close et al., 2007b). Maintaining balance is a complex undertaking involving many body systems which are affected by ageing and susceptible to disease induced impairments. Many prospective studies have shown that tests of standing, leaning, reaching, stepping and walking can delineate fallers from non-fallers. In the main, the more challenging the balance activity, the stronger its association with falls (Close et al., 2005).

2.4 Interventions to prevent falls

Over the past two decades on the basis of the identified risk factors, investigators have turned their attention to studying interventions to prevent falls (Carter et al., 2001; Chang et al., 2004; Herwaldt & Pottinger, 2003; Lord, Sherrington, Menz, & Close, 2007b; Tinetti, 2001; Todd & Skelton, 2004). Results from a host of clinical trials have been summarised into systematic reviews, meta-analyses (Campbell & Robertson, 2007; Chang et al., 2004; Gates et al., 2008; Gillespie et al., 2009; Sherrington, Whitney et al., 2008) and evidence-based guidelines (American Geriatrics Society et al., 2001; Feder, Cryer, Donovan, Carter, & The Guidelines Development Group, 2000). These provide clear evidence that falls in older people can be prevented.

In general, studies investigating fall prevention have followed two main paths. The first, a multi-component approach has targeted multiple risk factors. These studies have typically included interventions such as medication adjustment, behavioural change recommendations, education and exercise programmes (Lord, 2004; Lord, Sherrington, Menz, & Close, 2007b). The second approach, single intervention, has consisted of one major category of intervention

delivered to all participants (Gillespie et al., 2009). Investigations of single interventions have mainly focused on exercise to promote strength and balance, environmental modifications and strategies to address hazardous medication use (Lord, 2004). Of the single interventions investigated, strength and balance-training appears to have been the most effective in preventing falls (Close et al., 2005).

A Cochrane review (Gillespie et al., 2009) reported that both single and multi-component interventions have been shown to be effective in community-dwelling populations. Moreover, a meta-regression analysis by Campbell and Robertson (2007) examined 14 trials and found similar effect sizes from single and multi-component strategies. Interestingly, while earlier systematic reviews and evidence-based guidelines supported the use of multi-component fall prevention interventions (American Geriatrics Society et al., 2001; Chang et al., 2004; Gillespie et al., 2003; Moreland et al., 2003; National Institute for Health and Clinical Excellence (NICE), 2004b), more recent systematic reviews suggest the benefits from multi-component interventions may not be as large as the earlier reviews indicated (Beswick et al., 2008; Gates et al., 2008).

Several authors have also pointed to potential limitations of multi-component interventions. In particular, it is often difficult to determine which components of a multi-component intervention were necessary (Chang et al., 2004; Gillespie, 2004; Lord, 2004). Furthermore, the cost effectiveness of multi-component interventions has been questioned on the basis that they are labour intensive (Carter et al., 2001) and likely to be expensive (Gates et al., 2008). Day et al. (2006) modelled the population level impact of proven fall initiatives for older people. They concluded that multi-disciplinary, multi-component management represented good clinical practice for those with a fall history, but was not relatively cost-effective for widespread implementation.

In general, multi-component fall prevention trials for a community dweller can be divided into those that provide direct management of the identified risk factors and those that refer participants to healthcare providers or existing programmes (Tinetti, 2008). Interestingly, a recent systematic review by Gates et al. (2008) found that earlier trials which involved delivery of interventions were more effective than trials that referred participants to interventions.

In summary, systematic reviews and RCTs show that single component interventions can effectively prevent falls. Furthermore, single component, when compared with multi-component interventions, are likely to be less resource intensive and less expensive to deliver.

2.5 Exercise interventions to prevent falls

An increasing number of RCTs provide evidence that specific types of exercise can significantly reduce both risk factors for falls and the incidence of falls in older people (Barnett, Smith, Lord, Williams, & Baumand, 2003; Campbell, Robertson, Gardner, Norton, & Buchner, 1999b; Chang et al., 2004; Day et al., 2002; Gillespie et al., 2003; Lord, Sherrington, Menz, & Close, 2007b; Province et al., 1995; Sherrington et al., 2004; Sherrington, Whitney et al., 2008; Todd & Skelton, 2004). Although exercise has been widely recommended in evidence-based guidelines for fall prevention (American Geriatrics Society et al., 2001; Feder et al., 2000; Moreland et al., 2003; National Institute for Health and Clinical Excellence (NICE), 2004b), there is limited evidence indicating the relative benefits of specific exercise programme components for optimal fall prevention (Lord, Sherrington, Menz, Close et al., 2007b; Province et al., 1995; Sherrington, Whitney et al., 2008). For example, two recent reviews, one by Lord et al. (2007b) and the other by Sherrington et al. (2008) synthesised the findings of RCTs into exercise interventions for fall prevention. These reviews provide some support for components commonly incorporated into clinical fall prevention programmes.

The review by Sherrington et al. (2008) excluded trials in which non-exercise interventions accounted for more than 25% of the intervention being evaluated. Their review included 44 trials (9,603 participants), six of which were conducted in institutional settings. The results showed the pooled estimate of the effect of exercise was that it reduced the risk of falling by 18% (rate ratio = 0.82, 95%CI 0.75 to 0.91, $p < .0001$, $I^2 = 62\%$). The review by Lord et al. (2007b) excluded multi-component interventions as it was deemed not possible to delineate the effects of exercise from the other components. Their review classified trials as preventing falls ($n=12$) and not preventing falls ($n=13$) on the basis of the intervention having a significant between-group effect on a fall outcome measure (number of fallers, fall rates or time delay to falling).

With reference to the reviews of Sherrington et al. (2008) and Lord et al. (2007b), Table 2-1 presents the exercise intervention programmes in RCTs showing an effect of the intervention on falls. This Table includes only trials conducted among community-dwellers and large enough to show an effect on falls in their own right. The related discussion refers to trials as 'successful' or 'unsuccessful' on the basis of whether they had effectively prevented falls, and does not consider the size of the effect, but purely whether effects seen were statistically significant.

Table 2-1: Characteristics of ‘successful’ individual and group exercise interventions for community dwellers in RCTs

(Lord, Sherrington, Menz, Close et al., 2007b; Sherrington, Whitney et al., 2008)

Studies in alphabetical order	Year	Sample size	Effect size. Rate ratio (95%CI)	Highly supervised	High balance-training	Functional exercise	Tailored intensity	Highly progressive	50+ total hours
Exercise in groups									
Barnett et al	(2003)	163	0.60 (0.36 to 0.99)	✓	✓	✓	✓	✓	✓
Buchner et al	(1997)	105	0.61 (0.39 to 0.93)	✓	✗	✗	✓	✓	✓
Day et al	(2002)	1090	0.82 (0.70 to 0.97)	✗	✓	✗	✓	✓	✗
Li et al	(2005)	256	0.45 (0.33 to 0.62)	✗	✓	✗	✗	✓	✓
Lord et al	(2003)	551	0.78 (0.62 to 0.99)	✗	✓	✓	✓	✓	✓
Means et al	(2005)	205	0.41 (0.21 to 0.77)	✓	✓	✓	✓	✓	✗
Skelton et al	(2005)	100	0.69 (0.50 to 0.96)	✓	✓	✓	✓	✓	✓
Voukelatos et al	(2007)	702	0.67 (0.46 to 0.97)	✗	✓	✗	✓	✓	✗
Wolf	(1996)	200	0.51 (0.36 to 0.73)	✗	✓	✗	✓	✓	✓
<i>Sub-total</i>				4/9	8/9	4/9	8/9	9/9	6/9
Individual exercise									
Campbell et al	(1997)	233	0.65 (0.50 to 0.84)	✗	✓	✓	✓	✓	✓
Robertson et al	(2001)	240	0.54 (0.32 to 0.91)	✗	✓	✓	✓	✓	✓
<i>Sub-total</i>				0/2	2/2	2/2	2/2	2/2	2/2
Total				4/11	10/11	6/11	10/11	11/11	8/11

2.5.1 Type of exercise

The Prevention of Falls Network Europe (ProFaNE) taxonomy describes six exercise categories: 1) gait, balance and functional training; 2) strength/resistance training; 3) flexibility training; 4) 3 dimensional training including Tai Chi and square stepping; 5) general physical activity (including walking); and 6) endurance training (Lamb, Hauer, & Becker). Research indicates that balance-training has been a common thread of effective exercise interventions to prevent falls (Province et al., 1995; Sherrington, Whitney et al., 2008). A meta-analysis by Sherrington et al. (2008) found the greatest relative effects of exercise on falls occurred for programmes which challenged balance, included an exercise dose greater than 50 hours and did not include a walking programme (rate ratio =0.59, 95% CI 0.51 to 0.68, 74% of between-study variability explained).

The Frailty and Injuries: Cooperative Studies on Intervention Techniques involved eight collaborative but independent randomised studies conducted at seven locations in America (Province et al., 1995). Five of the trials investigated the effects of exercise on reducing fall risk factors in community-dwelling older people. Province et al. (1995) showed that of the five programmes, those that had specifically targeted balance were most effective in reducing risk factors for falls.

Although balance-training appears to be an effective approach for reducing falls, a range of different exercise activities have been included under the umbrella of balance-training (National Public Health Partnership, 2005b). For example, Sherrington et al. found that ‘successful’ interventions involved disparate exercise regimens (Table 2-1), from Tai Chi conducted in group settings (Li et al., 2005; Wolf et al., 1996), to individualised home-based strength and balance exercise (Campbell et al., 1997; Robertson, Devlin, Gardner et al., 2001). Hence questions remain as to the type of exercise that will most effectively promote balance and therefore prevent falls.

Functional task training was not a distinguishing feature between ‘successful’ and ‘unsuccessful’ trials (Lord, Sherrington, Menz, Close et al., 2007b; Sherrington, Whitney et al., 2008). However, Carr and Shepherd (1998) argue that exercises which are closely related to the task they seek to improve (such as walking, reaching and climbing stairs) will be most effective at increasing control of movement and optimising functional performance on these tasks. Their argument is supported by evidence that muscles are strongest for the type of contraction and joint range in which they have been strengthened (Jones, Rutherford, & Parker, 1989; Nugent, Schurr, & Adams, 1994; Sale, 1988) and that muscular control of balance varies according to the task performed (Bouisset & Zattara, 1987).

Progression was not a distinguishing feature between ‘successful’ and ‘unsuccessful programmes’ (Lord, Sherrington, Menz, Close et al., 2007b; Sherrington, Whitney et al., 2008). However, there was some evidence to support the inclusion of tailored intensity in fall prevention exercise programmes. Ten of the 11 ‘successful’ programmes (compared to five of the 12 ‘unsuccessful’ programmes) included tailored exercise intensity (Lord, Sherrington, Menz, Close et al., 2007b).

2.5.2 *Exercise dose*

To date fall prevention exercise interventions have varied greatly in terms of frequency, session length and programme duration. As a general rule, skill in performing a task increases as a direct result of the amount of practice (Carr & Shepherd, 1998). Sherrington et al. (2008) used a measure of exercise dose that combined frequency of exercise on a weekly basis with length of programme. They found eight of the 11 programmes that had effectively prevented falls used an exercises dose ≥ 50 hours over the study period (Table 2-1). Despite the wide variation across programmes, the total dose explained a significant and independent amount of variability with regard to the effectiveness of the exercise trials.

2.5.3 *Supervision*

For exercise programmes in general, supervision is key to promoting correct technique, optimal challenge and safety (Lord, Sherrington, Menz, Close, & Whitney, 2007a). Ongoing supervision also plays a role in maintaining adherence to exercise (Hillsdon, Thorogood, Anstiss, & Morris, 1995). It is recognised that different types of exercise require different levels of supervision (Lord, Sherrington, Menz, Close et al., 2007a). However, levels of supervision required for optimal fall prevention remain unclear (Chang et al., 2004). On the one hand, to prevent falls interventions need to be sufficiently challenging yet safe (Sherrington et al., 2004), as well as monitored and progressed in order to remain challenging (Lord, Sherrington, Menz, Close et al., 2007a). These requirements point to a need for supervision. On the other hand, only four of the 11 trials which effectively prevented falls were highly supervised (Lord, Sherrington, Menz, Close et al., 2007b).

2.5.4 *Group exercise vs. individual programme*

Fall prevention interventions have typically been delivered as exercise classes at a central venue, a supervised programme at the homes of participants, or a combination of class with home programme. There is ongoing controversy as to whether interventions are best delivered

on a group or individual basis. Previous studies with falls as an outcome measure have not directly compared group and individual exercise settings to determine if there is a difference between adherence and effectiveness (Lord, Sherrington, Menz, Close et al., 2007b). However, interventions delivered on either an individual or group basis have successfully prevented falls (Barnett et al., 2003; Campbell et al., 1999b).

Evidently, there are pros and cons to both settings. For example, a dislike of group activities may act as a barrier to participating in group-based fall prevention activities (Yardley, Bishop et al., 2006). Alternatively, persons undertaking home-based fall prevention programmes may miss some of the advantages associated with group exercise including; assistance and support from the instructor, the structure provided by having a regular time allocated to the exercise (Lord, Sherrington, Menz, Close et al., 2007a), and mutual support and encouragement provided by the group (Lord, Sherrington, Menz, Close et al., 2007a). Interestingly, research with healthy elderly persons indicates factors such as self-esteem, confidence and zest for life may be stimulated in group activities (Andersen, Anderson, Forchhammer, Povlsen, & Topsoe-Jensen, 1988).

A further consideration in relation to the exercise setting is that interventions delivered at participants' homes or an institutionalised setting can be costly and inaccessible for many of the elderly. In an effort to address these difficulties researchers have begun to consider telemedicine modes of delivery. A recent study from the Republic of Slovenia investigated a balance testing apparatus in remote assessment of the elderly (Matjacic, Bohinc, & Cikajlo, 2009). This study compared the new apparatus with the widely used Berg Balance Scale. Results showed a high degree of correlation between both tests in a sample of 20 elderly persons. In conclusion Matjacic et al. (2009) suggested their findings may assist the development of remotely delivered home-based mobility training programmes.

2.5.5 *Issues with translating innovations into practice*

It has been argued that maximizing the adoption of evidenced based practice is a major factor in determining healthcare outcomes and supporting efficient use of health resources (Buchan, Sewell, & Sweet, 2004; Sanson-Fisher, 2004; Tunis, Stryer, & Clancey, 2003). Paradoxically, while considerable amounts of money have been spent on health research, relatively little attention has been paid to ensuring the findings of research are implemented into normal clinical practice (Bero et al., 1998). Perhaps not surprisingly, one of the most consistent findings across health research is the gap between best practice (as determined by scientific evidence) and actual clinical care (Grol & Wensing, 2004e).

The gap between evidence and practice is particularly evident in the area of fall prevention (Robinson, 2008; Tinetti, 2001). Close and McMurdo on behalf of the British Geriatrics Society Falls and Bone Health Section (2003) provided the following summation:

“Despite the rapid growth of knowledge in recent years with respect to the effectiveness of fall prevention, clinical practice has lagged far behind. There are few other examples of such a common and serious presentation, with such compelling evidence of effective treatment that has been so neglected by health care professionals” (p. 495).

According to Close (2005b), all professionals involved in the care of older people have a responsibility to apply fall prevention strategies for which there is good evidence. Hence, a current major challenge in the field of fall prevention is to ensure that results from trials are successfully translated to everyday clinical settings with usual healthcare providers and comparatively limited resources (Bloem, Steijns, & Smits-Engelsman, 2003; Close, 2005a; Elley, 2008; Elley et al., 2006; Wagner et al., 1994).

Ideally, knowledge transfer should be guided by research based evidence on the effectiveness of various implementation strategies (Wensing, Bosch, & Grol, 2010). However, numerous systemic reviews of different strategies have concluded that there are no ‘magic bullets’ for ensuring change, most strategies were effective under some circumstances; none were effective under all circumstances (Bero et al., 1998; Cockburn, 2004; Grimshaw et al., 2001; Grol & Grimshaw, 1999; Oxman, Thomson, Davis, & Haynes, 1995). While these systematic reviews provide insights into the likely effectiveness of different strategies, it remains unclear just what approaches are most effective in which settings (Grimshaw & Eccles, 2004; Grol & Wensing, 2004e). This is a pivotal gap, because adapting evidence to the local context is a necessary step in translating evidence into practice (Harrison, Legare, Graham, & Fervers, 2010). To address this gap, Grimshaw and Eccles (2004) recommend that future research test implementation strategies and the implementation process across a range of settings.

Lomas (1993) defined implementation as an active process that involves systematic efforts to encourage adoption of the evidence by identifying and overcoming barriers. The gap between evidence-based recommendations and delivery of care may be due to a range of barriers at different levels of the healthcare organisation (Grol & Wensing, 2004e; Harrison et al., 2010; Straus, Tetroe, & Graham, 2010; Wensing et al., 2010). Therefore, achieving lasting change will usually require a combination of different strategies linked to specific barriers within different levels of the organisation (Bero et al., 1998; Cockburn, 2004; Grol, 1997; Wensing et al., 2010).

Moreover, research is required to determine the linkage between these barriers and strategies (Wensing et al., 2010).

The following section summarises some of the barriers and strategies described in the literature. By way of setting the scene, it is important to point out that some barriers and strategies relate to features of the innovation itself. Is it a ‘good product’? Does it fit the needs and circumstances of the target group? Is it usable, accessible and attractive? Some barriers and strategies relate to characteristics of the target group (professionals who carry out the innovation) or the patients who use the innovation. Other barriers and strategies relate to the economic, administrative and organisational context (Grol & Wensing, 2004c).

Rogers (1983) developed one of the better known theoretical approaches to implementation. His work described five elements of a new clinical behaviour that could influence whether implementation occurred. The first is *relative advantage*. According to this element, decisions about implementing evidence are driven by the interplay between the interests of the patient, the clinician and the healthcare system. For the clinician, achieving better patient outcomes is usually the most important motivator. Pleasure in one’s work is another commonly cited benefit (Cockburn, 2004). Advantages, such as these, are weighed against possible disadvantages of implementation, for example the extra time commitment, disruption of normal practice and additional costs (Grol & Wensing, 2004a). Second, *compatibility* refers to the degree to which the innovation complies with existing values and the needs of potential adopters. Third, *complexity*, is the degree to which an innovation is perceived to be difficult to understand and awkward to use. An implementation is more likely to be adopted if it is simple and well defined (Sanson-Fisher, 2004). Fourth, *trialability* is the degree to which people can try out the innovation on a small scale to determine whether it works and can be undertaken without major problems. Finally, *observability* refers to the degree to which results of the innovation are visible. Showing that the innovation is feasible in practice, and quickly accomplishes desired results, can stimulate its implementation.

Barriers and facilitators similarly need consideration. It is acknowledged that leadership may facilitate implementation. For example, a leader may bring expertise in the field, and play a central role in communicating the aim and involving the target group (Grol & Wensing, 2004c). Leadership may take a variety of forms, with the relationship between leader and provider(s) moving from a ‘hands on’ development relationship to a ‘hands off’ consultative or facilitative relationship (NSW Health Department, 2001).

According to Close (2006), one of the main challenges in translating fall prevention research is in providing a workforce with the necessary education, training and skills to deliver evidence-based care. Mainstream literature on knowledge translation recognises that individual professionals may need to be informed, trained and supported to incorporate the latest evidence into their daily work (Grol & Wensing, 2004e; Leigh, Long, & Barraclough, 2004). This is more likely in fields where the information is complex or extensive (Grol & Wensing, 2004d). Fall prevention is one such area, given the many methods by which risk can be identified, heterogeneity of the population at risk and plethora of available interventions (Close, 2005a). Notwithstanding potential shortfalls in expertise, other key implementation barriers may be that providers do not have the time or resources necessary to fit evidence into their existing routines (Grol & Wensing, 2004d; Harrison et al., 2010).

Individual or group education can be used to increase expertise and provide the support and encouragement necessary to accomplish a change (Grol & Wensing, 2004d). Outreach visits and networks are two examples of ways in which education and support may be provided. Outreach visits involve trained personnel meeting with providers in their practice. There is evidence that personal tuition, tailored to provider's questions, can contribute to creating a positive attitude towards innovations (Grol & Wensing, 2004b; Sanson-Fisher, 2004; Wensing et al., 2010). There is also evidence to suggest that implementation of innovations can occur through local networks of care providers (McLeroy, Bibeau, Steckle, & Glanz, 1988). By investing time in key figures, visiting them, contacting them by phone, showing interest in their specific local situation, the implementation of an innovation may be facilitated (Grol & Wensing, 2004b).

As discussed earlier, barriers to translation can occur at various levels of the healthcare system. In some instances, organisational structures exert a constraining influence on implementation (Leigh et al., 2004; Reason, 2000). The amount and type of available resources (e.g. professionals to deliver the programme, physical space and financial support) will determine if and how an innovation is implemented (Grol & Wensing, 2004c; NSW Health Department, 2001). Leigh et al. (2004) point out that hospitals are often characterised by clinician-administrator divides, and emphasised that while clinicians can work for change within their immediate areas, organisational issues beyond their control but affecting their practice also need to be addressed. In the context of fall prevention, a particular challenge relates to ensuring that scarce resources are used most effectively and that clinicians and managers work in partnership, channelling energy, expertise and funds to services that are known to prevent falls (Close, 2005b).

2.5.6 Building capacity

Capacity building occasionally happens as an activity in its own right, but is most often combined with the development and delivery of a health promotion programme (Hawe, Noort, King, & Jordens, 1997). It can occur both within programmes and within systems, leading to greater ability of people, organisations and communities to promote health (NSW Health Department, 1999). Capacity building develops sustainable skills, resources and independence, thereby increasing the likelihood that programmes will be sustained, and multiplying health gains many times over (Hawe et al., 1997; NSW Health Department, 1999, 2001). According to Hawe et al. (1997) to assess the value of health promotion activity in terms of the ‘amount’ of health gain delivered would be like using a ruler to measure a sphere. Capacity building represents a ‘value-add’ dimension of health outcomes.

Despite ongoing exploration of mechanisms to successfully monitor and evaluate capacity building efforts, for the most part, capacity building indicators cannot be entirely evidence-based (NSW Health Department, 1999, 2001). What is clear is that all capacity building is context rich. Context refers to the range of physical, organisational, economic and cultural environments within which a programme sits. Hence, strategies and approaches to build capacity must always take context into account (NSW Health Department, 1999).

Capacity building can be used to create an infrastructure for delivering a particular type of health programme and may be applicable in the field of fall prevention. Success can be promoted by using capacity building strategies which span three key action areas within the local context; organisational development (structure), workforce development (skills) and resource allocation (Hawe et al., 1997; NSW Health Department, 2001).

2.6 Rural healthcare

The Australian Institute of Health and Welfare (2008a) defines ‘rural and remote’ as all areas outside the major cities. According to this definition, around 6.5 million Australians (32%) live in rural and remote areas. Although the populations of rural and remote Australia are diverse in nature (Dade Smith, 2004; Fraser et al., 2002), they share many health concerns (Allan, Ball, & Alston, 2007; Fraser et al., 2002). Overall, rural and remote dwellers have poorer health than their city counterparts, reflected in generally higher levels of morbidity and mortality, disease and health risk factors (AIHW, 2008a; Welch, 2000).

The aged and those with chronic diseases are often over-represented in rural areas (Australian Bureau of Statistics, 2007; Australian Institute of Health and Welfare, 1998). In the capital cities 20.6 % of the population were 55 years and over in 1996, compared with 25 % for 'small rural centres' and 24.4 % for 'other rural areas' (National Rural Health Alliance, 2004).

The prevention of accidental falls among older people presents a particular challenge to rural health providers. The National Aging Research Institute (2004) identified that for rural communities there is a paucity of epidemiological data on falls and falls injury incidence, and fall prevention intervention research. The Institute highlighted that rural Australia requires further consideration in terms of fall prevention interventions and suggested there are likely to be unique differences that necessitate a novel approach to fall prevention in rural areas. Interestingly, the Australian Institute of Health and Welfare report entitled 'Health in Rural and Remote Australia' (Australian Institute of Health and Welfare, 1998) pointed to a higher mortality from falls among aged persons in rural and remote communities compared with metropolitan centres and suggested that the related health needs of these rural and remote populations were not being met.

2.6.1 The issue of access

A fundamental principal underpinning the Australian health care system is access to health services, regardless of geographic location (National Rural Health Policy Forum and National Rural Health Alliance, 1999). Yet, one of the most striking disparities between metropolitan and rural and remote areas is the limited access to or reduced availability of health services (Australian Institute of Health and Welfare, 2008a, 2008b; Bourke et al., 2004; Larson, 2002; National Rural Health Alliance, 2005). Many factors influence accessibility. Rural health services typically provide care to a larger number of people and a more dispersed population than urban services. At the same time rural services tend to be smaller, limited in scope, less resourced and incur additional expenses associated with distance (AIHW, 2008a; Bourke et al., 2004; NRHA, 2005).

2.6.2 The rural workforce

Recruitment and retention

In Australia, there are ongoing problems with recruiting, supporting and retaining the rural health workforce (Australian Institute of Health and Welfare, 2005b; Gregory, Armstrong, & Van Der Wyden, 2006). There are fewer medical and allied health workers per head of

population than in metropolitan areas (AIHW, 2005b; Bourke et al., 2004; Fitzgerald, Hornsby, & Hudson, 2000; 2006; Larson, 2002; Morris & Palmer, 1994). For example, in 1998 the number of physiotherapists per 10,000 population was 30 for remote areas, 47 for rural areas and 60 for metropolitan areas (Australian Institute of Health and Welfare, 2000). Yet, the demand for rural and remote physiotherapists is high (Sheppard, 2001). Following doctors and nurses, physiotherapists are the third most sought after health professionals within rural and remote communities (Jones-Roberts, 1998).

Shortages of health professionals impacts on the quantity and quality of care available to older people (National Rural Health Alliance/Aged and Community Services Australia, 2005). Notably, the National Institute of Clinical Excellence (2004b) advocated that fall prevention strength and balance-training should be monitored by appropriately trained professionals. Furthermore, Lord et al. (2007b) found that most exercise programmes 'successful' in preventing falls had been delivered by physiotherapists and exercise instructors. However, the limited availability of rural physiotherapists has implications for the delivery of fall prevention exercise interventions in rural communities.

Professional isolation and professional development

The National Institute of Clinical Excellence (2004b) and National Public Health Partnership publication entitled 'National Falls Prevention for Older People: 2004 Onwards' (2004) emphasise that workforce training and development that is working on and supporting the capacity of health professionals, is an essential component of reducing falls. However, geographic distance is often a barrier to rural practitioners accessing professional development. Many professional education activities are only available in metropolitan centres, and travel to distant centres has implications in terms of time away from both the workplace and home (Curran, Fleet, & Kirby, 2006; Williams, D'Amore, & McMeeken, 2007). Moreover, reduced access to continuing professional education is one aspect of a broader concern, that of professional isolation. Professional isolation has been identified as a key issue associated with rural clinical practice (Curran et al., 2006; Dade Smith, 2004; Williams et al., 2007). Professional isolation is characterised by decreased contact and support from fellow professionals and administrators.

These difficulties of accessing continuing professional education and support are potentially compounded by the competing tensions of managers who are under increasing pressure to control costs, and health professionals expected to deliver up-to-date evidence-based practice (Southon, 1996) in the face of a continuing knowledge explosion in their fields (Sheppard, 2005). Health researchers and policy makers have suggested possible means of providing

services in the face of these difficulties. For example, Schoo, Stagnitti, Mercer and Dunbar (2005) propose creating a professional network supported by regional organisation of resources and infrastructure. Sheppard (2001) points to the development of flexible delivery education and support to meet individual clinician's needs in a timely manner.

The specialist generalist

Given that there are fewer health professionals and services in rural and remote communities, individual rural professionals commonly provide a broader scope of services than their metropolitan counterparts (Arthur, Sheppard, & Dare, 2005; Sheppard, 2001). The context of greater distances; smaller populations; fewer health professionals; fewer services; high workload; relative professional isolation; and rural culture, demographics and epidemiology, together with the practicalities of service provision without ready access to resources, technology and specialist personnel available in the cities, combines to create a distinct practice paradigm (Arthur et al., 2005; Bourke et al., 2004; Chenoweth, 2004; Schoo et al., 2005; Sheppard, 2001). Physiotherapists who operate within these contexts are often described as 'specialist generalists'. That is, they are frequently called upon to be 'generalists', necessitating the breadth of knowledge to provide a wide range of services. At the same time, they are required to be specialists, being experts in each service they deliver (Arthur et al., 2005; Sheppard, 2005). In the context of fall prevention, physiotherapists commonly deliver exercise interventions (Lord, Sherrington, Menz, Close et al., 2007b). Hence rural physiotherapists, already responsible for delivering a broad array of services, are often also required to have the knowledge and skills to proficiently deliver fall prevention exercise programmes.

Issues with transport

Accessible and affordable transport is known to be a major concern for older people in terms of their ability to access services and engage with their communities (AIHW, 1998; Hussain, Marino, & Coulson, 2005; NRHA, 2005). Limited transport options can cause older people to become isolated, leading to deterioration in physical and mental health status (National Rural Health Alliance/Aged and Community Services Australia, 2005).

Transport is particularly problematic in rural areas and has been identified as a key rural health issue (Wakerman & Humphreys, 2002). Travel to centralised medical facilities takes time and costs money (National Rural Health Alliance/Aged and Community Services Australia, 2005). Moreover, public transport infrastructure is minimal in most of rural Australia. In particular, there is often no public transport to required destinations. Where available, it may not meet the needs of older people, due to timetabling and route constraints, or expense (National Rural Health Alliance/Aged and Community Services Australia, 2005). Therefore, rural life generally

requires private transport (Bourke et al., 2004). However, many older Australians do not have their own vehicle, often because of disability or cost (National Rural Health Alliance, 2004; National Rural Health Alliance/Aged and Community Services Australia, 2005).

Lack of transport is known to impact participation in metropolitan fall prevention exercise interventions (Barnett & Smerdely, 2002; Nitz & Choy, 2004) and is likely to be a particular problem for rural fall prevention exercise programmes. The NSW Health 'Rural Falls Injury Prevention Program: Report of Interventions and Outcomes' (2005) and Tasmanian Department of Health and Human Services 'Focus on Falls: Needs Assessment for Fall Injury Prevention for Older People in Tasmania' (2005) report, both highlighted that for people in rural and remote areas, accessibility to services was a major barrier to fall prevention.

Healthcare models for rural communities

There is now widespread acceptance that healthcare models which work well in metropolitan areas cannot simply be replicated in rural and remote communities (National Rural Health Alliance, 2002), at least in part due to difficulties with access and differences in the nature of rural and remote communities compared with metropolitan centres (Swindlehurst, Deaville, Wynne-Jones, & Mitchinson, 2005). Consequently there has been a movement away from the 'shrunk urban model' towards services that match the needs of rural communities (Veitch & Battye, 2008). Moreover, a variety of local models of healthcare delivery are required to reflect the diversity of the people and environments of rural and remote Australia (Jones, 2008; Sheppard, 2001). Therefore research is needed to address the issues of rural and remote communities and determine the models of service delivery that will work effectively in these communities (National Rural Health Alliance, 2004). So the challenge for rural health professionals is to provide empirical evidence of what works well, where and why (Humphreys, Wakerman, & Wells, 2006).

2.7 Interventions to prevent falls among rural older people

A number of innovative rural fall prevention programmes have been developed. However the researcher identified only eight published studies of interventions which focused on, or incorporated exercise as a means of reducing fall risk factors or falls among rural community-dwellers. This literature search combined terms for ageing ('elder', 'elderly', 'aged', 'old', 'older') and terms for rural ('rural', 'regional', 'remote', 'country'). Databases searched include; AMED (Allied and Complementary Medicine), CINAHL (Cumulative Index to Nursing and Allied Health Literature), Embase (Excerpta Medica Database), MEDLINE (R) (Medical

Literature Analysis and Retrieval System Online), PEDro (The Physiotherapy Evidence Database), Proquest, PubMed.gov, and SPORTDiscus. These databases were searched to earliest records or to 1948. Searches were not restricted by language.

Identified studies comprised three RCTs, two quasi-experimental designs, one prospective cohort design and two 'evaluations'. The following Tables provide an overview of the eight studies. Table 2-2 presents the four studies which investigated multi-component interventions and Table 2-3 presents the four studies which investigated or compared single interventions.

As is evident from the information presented in Table 2-2 and Table 2-3, interpretation of the eight studies was hampered by methodological issues within studies and variability between studies with respect to design, type and intensity of exercise. Nevertheless, key findings and issues raised by the studies are discussed in sections 2.7.1 to 2.7.3.

Table 2-2: Rural multi-component interventions to reduce risk of falls or falls

AUTHOR LOCATION	STUDY DESIGN OBJECTIVE	METHOD	KEY RESULTS	COMMENTS
Kempton, Van Beurden, Sladden, Garner & Beard (2000); North Coast of NSW, Australia	Controlled population based prospective cohort study comparing randomly selected samples from intervention (estimated population 79,425) and control area (estimated population 61,752) target populations. Also repeat cross-sectional (annual) reviews of fall related hospitalisations.	<p>A four year (1992-1995) multi-component intervention targeting fall related knowledge, attitudes, behaviours and risk factors. Self selected audience for fall awareness, gentle exercise and medication classes. Control community received no intervention.</p> <p>Cohort study (1991-1995): randomly selected community- dwellers ≥ 60 years enrolled into intervention and control area cohorts.</p> <p>Cross-sectional study (1991/1992-1994/1995): all residents aged ≥ 60 years from intervention and control areas hospitalised with fall related injuries.</p>	<p>22% non-significant lower incidence of self-reported falls in the intervention compared to the control cohort ($p=0.17$).</p> <p>20% lower fall related hospitalisation rate in target group residents from intervention compared to control areas ($p<0.01$).</p> <p>A significant increase in the intervention participants wearing safe footwear (35%), non-significant improvements in self-reported balance (9%) and physical activity (6%).</p>	<p>Appropriate use of a control community.</p> <p>Loss to follow-up rate 30%.</p> <p>Hospital rate admissions may be subject to annual fluctuations.</p> <p>Additional follow-up periods are required to confirm the observed trends.</p> <p>Outcome data was obtained from administrative databases. The completeness and reliability of these databases to obtain epidemiological measures of injury incidence may be problematic.</p> <p>Unclear what constituted gentle exercise.</p> <p>Minimal physical tests.</p>
Yates & Dunnagan (2001); Montana, USA	Quasi-experimental design to investigate the effect of a multi-component programme on fall risk factors.	<p>Ten week multi-component programme (fall risk education, home exercise programme, nutrition counselling, environmental hazard education).</p> <p>Ten week home exercise programme focused on strength, coordination, balance and mobility through 19 chair-based exercises with weights. Participants requested to exercise 15 minutes/three times per week.</p> <p>$n=37$ community dwellers; median age 77 (range 67-90) years (intervention $n=18$, control $n=19$).</p>	<p>The intervention group showed statistically significant improvement in:</p> <p>Balance-Tinetti balance assessment ($p=.000$)</p> <p>Lower extremity power- power generated from sitting to standing ($p=.001$)</p> <p>Fall efficacy-Falls Efficacy Scale ($p=.025$)</p> <p>Reduction in environmental hazards- ordinal scale; checklist developed by researchers</p> <p>Nutritious food behaviour-ordinal scale.</p>	<p>55% of the intervention group performed the exercise programme ≥ 3/week for the ten week intervention period.</p> <p>1-tailed t tests compared mean change scores between groups for the physical measures. It is preferable to use a 2-tailed test as effect could go either direction. A 1-tailed t test assumes effect in one direction.</p> <p>Conclusions limited by small sample size.</p>

Brown (2004); South-East of South Australia	Observational study- multi-component intervention programme across community, residential aged care (RAC) and hospital settings.	<p>Three year intervention;</p> <p><u>Community</u></p> <p>Information provision & educational sessions Advice on diet, activity, smoking & alcohol Tai Chi Quan classes (four times per week) Physiotherapist prescribed exercise programme assessment of fracture risk, environmental fall hazards supply of walking aids & hip protectors Improved secondary prevention after a fall/fracture.</p> <p><u>RAC</u></p> <p>Fall risk assessment at admission & reviews Multidisciplinary assessment of high risk fallers Promotion of calcium & vitamin D supplements, hip protectors, medication reviews Provision of regular exercise.</p> <p><u>Hospitals</u></p> <p>As for RAC except no promotion of calcium & vitamin D, or exercise</p> <p>7553 people \geq 65 years</p>	The rate of hospital admission after a fall decreased from 12% in the first 12 months to 7% in the second. The total fracture rate decreased from 7% in the first 12 months to 4% in the second. Both reductions were statistically significant at $p < 0.001$	<p>There may have been fallers in the community who had no contact with any service following their fall.</p> <p>Apart from hospital admission and injury, other consequences of falls were not sought.</p> <p>There was no reporting prior to commencing the interventions. Hospital rate admissions may be subject to annual fluctuations.</p> <p>Outcome data was obtained from administrative databases. The completeness and reliability of these databases may be problematic.</p> <p>Limited explanation of Tai Chi Quan classes.</p> <p>Unclear who received the physiotherapist prescribed exercise programme, what subjective/objective assessment measures were taken and the results of these.</p>
Casteel, Peek- Asa, Lacsamana, Vazquez & Kraus (2004); Fresno & Tulare rural counties of California, USA	Non-randomised controlled study 'Evaluation' of outcomes in the pre-and post intervention periods.	<p>Multi-component intervention including management of environmental hazards, medication, alcohol use, vision and hearing impediments. Provision of a lower limb strength and balance programme (physical activity plan and referral to community exercise programme).</p> <p>$n=950 \geq 55$ years (participant $n=107$, non-participant $n=843$)</p>	No significant reduction (at the 5% level) in the risk of falling for the intervention compared to non- participant group.	<p>Difficulty in finding a comparison group as the programme was not randomised. Therefore the comparison group was limited to persons not offered the programme or those who had not met the risk requirements for enrolment.</p> <p>Large differences in the size of participant and non- participant groups.</p> <p>Little information provided about the exercise programme components.</p>

Table 2-3: Rural single interventions to reduce risk of falls or falls

AUTHOR LOCATION	STUDY DESIGN OBJECTIVE	METHOD	RESULTS	COMMENTS
Yokokawa et al. (2003); rural community in Japan N.B. Only English abstract available	RCT to determine the effects of the exercise programme on a range of physical and psychological factors	Fortnightly exercise classes over four months. Usual care control group. Physiotherapists and care staff instructed the exercises. n= 71 community dwellers \geq 75 years (intervention n=34, control n=37)	Significant interaction effects on body mass ($F=5.623$, $P<0.01$) and Timed Up and Go ($F=6.541$, $P<0.05$). No significant changes for other physical and psychological factors	Authors concluded that specific exercises could improve some aspects of physical performance and may contribute to decrease falling. Selection limited to persons that used community health and welfare services - may have biased sample. High levels of adherence – intervention group participated in all sessions. 69% completion rate (attended base-line & follow-up assessments).
Sousa & Sampaio (2005); rural north of Portugal	RCT to investigate the effect of the exercise programme on two tests related to fall risk; Functional Reach Test & Timed Up and Go.	14 week progressive strength training programme (three times per week) n=20 community dwellers (range 65-85 years)	The intervention group improved Functional Reach Test (+9.4%) and Timed Up and Go (-15%) results from pre-test to post-test and showed a trend toward a significant improvement on both tests.	Small exclusively male sample. Limited explanation of the type of exercises included. Only two outcome measures.
Lin, Hwang, Wang, Chang & Wolf (2006); Shin-Sher, a rural township located in western central Taiwan.	Quasi-experimental design to examine the effect of a Tai Chi programme on injurious falls, balance, gait and fear of falling	One year intervention period. Participants enrolled from six rural villages. All villages were provided with education. Four of the villages (n=728) were designated 'control villages', two villages (n=472) were designated 'Tai Chi villages'. Participants from the 'Tai Chi village' were invited to attend Tai Chi classes (held one hour/six times per week). 88 participants participated in these classes & were referred to as 'Tai Chi practitioners'. n=1,200 community dwellers aged \geq 65 years.	There were no statistically significant reductions in injurious falls across the groups. Therefore it is not possible to conclude that participation in the Tai Chi intervention was effective in reducing injurious falls. There were no differences between the groups for the secondary measures of balance, gait and fear of falling.	Falls were narrowly defined as injurious falls. This may have limited the ability to detect differences resulting from the intervention. Incidence of injurious falls was ascertained by telephone each three months – diaries not used. Relying on participant recall may have impacted accuracy of the data. Large variations in group numbers (n =728 & n=472)

Lin, Wolf, Hwang, Gong & Chen (2007); Taichung County in western central Taiwan	RCT to compare the effect of three fall prevention programmes; education, home safety assessment and modification, and exercise training.	<p>Four month intervention.</p> <p>Exercise training group-stretching, strengthening & balance-training (40-60 minutes/ three times per week)</p> <p>Education group- eight social visits (fortnightly) & pamphlets providing fall prevention information</p> <p>Home safety and assessment and modification- 28 item home hazard assessment, modifications & recommendations</p> <p>Assessment using the brief version of the World Health Organisation Quality of Life instrument (WHOQOL)</p> <p>n=150 community dwellers ≥ 65 (mean 76.8) years, n=50 in each group</p>	<p>Exercise training was superior to the other two interventions.</p> <p>Score change for the exercise training group was greater than for the education group by the following:</p> <p>2.1 points > on the physical domain (95% CI=-1.2-5.3)</p> <p>3.8 points > on the psychological domain (95%CI=0.7-7.0)</p> <p>3.4 points > on the social domain (95% CI = 0.7-6.1)</p> <p>3.2 points greater on the environmental domain (95%CI =0.6-5.7)</p> <p>The exercise training group also had greater improvements in functional Reach Test, Tinetti Balance and Gait, and Fear of Falling than the education group.</p>	<p>Exercise programme well described & included weight-bearing exercise.</p> <p>Missing data (from those bedridden or deceased) may have biased the results.</p> <p>Different response rates between the groups may have biased the results.</p> <p>All participants had experienced a recent fall. As there was no control group, the degree to which natural resolution contributed to results is unknown</p>
---	---	---	--	---

2.7.1 Multi-component interventions

Two of the rural multi-component interventions, Brown (2004) and Kempton et al. (2000) led to a significant reduction in the fall related hospitalisation rate (Table 2-2). As discussed previously, the cost effectiveness of multi-component interventions has been questioned on the basis that they are labour intensive (Carter et al., 2001) and likely to be expensive (Gates et al., 2008). For example the South Australian study by Brown (2004) took three years and employed both a Project Manager and Project Officer. Because many rural communities have limited resources and lack health care services (Yates & Dunnagan, 2001), their capacity to provide similar multi-component fall prevention interventions may be limited.

Only one of the multi-component interventions, Yates and Dunnagan (2001) provided details of the exercises. As discussed earlier, previously effective fall prevention exercise programmes have typically challenged balance (Liu-Ambrose, Khan, Eng, Lord, & McKay, 2004). However, the Yates and Dunnagan (2001) programme focused on chair-based exercises. Nevertheless, their study, despite its small sample ($n=37$), reported reductions in some risk factors (Table 2-2).

2.7.2 Single interventions

Three of the rural studies investigated single exercise interventions. These programmes varied widely with respect to type of exercise (from strength training to Tai Chi), frequency (number of sessions per week) and duration (length). One study Yokokawa et al. (2003) found two significant effects (Timed Get-Up-and-Go and body mass). The remaining studies found no significant effects (Lin et al., 2006; Sousa & Sampaio, 2005).

Lin et al. (2007) conducted an RCT to compare three different interventions; exercise, home safety assessment and modification, and education. They identified that in several domains of the WHOQOL brief version, exercise was superior to education, and home safety assessment and modification. However, meaningful interpretations of changes in QOL scores are generally considered difficult, because the statistical significance of changes in QOL scores implies little about clinical significance (Lin et al., 2007).

In summary, of the eight rural studies identified, none found a statistically significant difference in the risk of falls or falls between groups. Casteel et al. (2004) reported that among the intervention participants, the odds ratio of falling decreased significantly during the year following participation in the programme ($OR = 0.47$; $95\%CI = 0.26, 0.84$). In comparison, the odds of not falling did not decrease significantly during the one year follow-up period among non-participants ($OR = 0.79$, $95\%CI = 0.59$ to 1.1). Brown (2004) found a reduction in the rate

of hospitalised admission after a fall. However, as there was no control group, it is not clear whether the reduction was due to the intervention.

2.7.3 *Lessons from rural fall prevention interventions*

Earlier parts of this thesis argued that the rural context presents a particular challenge to providing fall prevention exercise interventions. While overall the published rural studies provided scant details of implementation models, some did touch on strategies to assist implementation in rural contexts. Yates and Dunnagan, from Montana State University, USA (2001) pointed out that the simplicity and low-cost nature of their rural programme distinguished it from previous programmes for community-dwelling older people. The authors suggested that these features may be particularly important to rural communities which often lack health resources.

Brown (2004) found it helpful to have a ‘champion’, preferably of medical or allied health background, committed to the project and with time to devote to it. Brown’s observation was consistent with one of the main findings of the Moore et al. (2008) review. This review of fall prevention projects in Victoria (2000-2007) identified the importance of a ‘key driver’, someone with an ongoing role, to support fall prevention activities at a local level.

2.8 Summary

Preventing falls in older adults is an area of substantial interest, given the associated morbidity, mortality and economic costs, when seen in the context of the projected demographic changes over the next 30 years. Despite a great deal of research into fall risk factors and interventions to prevent falls, there are still gaps in the evidence that need addressing. For example, while there is evidence that balance-training exercise is effective in reducing rates of falls in community-dwelling older adults; further research is needed to investigate the effectiveness of different types and intensities of exercise programmes, and to tease out programme components important for preventing falls.

Despite the growing body of evidence that fall prevention interventions are effective, transferring this evidence into practice remains a challenge. In particular, there is a need to incorporate fall prevention exercise programmes into daily clinical practice, with good effect and acceptance. Meeting this challenge will be assisted by identifying barriers and facilitators to innovations in local contexts.

The challenge of translating fall prevention evidence into practice is especially difficult in rural areas, where a number of unique factors come into play. First, the ageing population is more marked in rural Australia than in the cities, and their health is generally poorer. Second, the challenges of providing effective health services to meet the needs of these rural communities is more difficult, for example due to; smaller towns, bigger distances and shortages of health professionals. Third, the majority of fall prevention studies have been conducted in metropolitan areas. Overall, it seems likely that modifications and local models will be required to meet the unique needs of rural Australian communities.

Of the eight rural fall prevention exercise studies identified, two showed a significant reduction in the fall related hospitalisation rate, and one found a significant effect on the Timed-Up-and-Go Test. However, interpretation of results was hampered by methodological issues within studies and further compounded by variability between studies. Moreover, these rural studies offered little specific guidance in terms of implementation. While the studies yielded some valuable insights, their volume and scope are inadequate to address the needs of older rural Australians.

CHAPTER 3: EXERCISE AND AGE CONSIDERATIONS IN FALL PREVENTION

3.1 Introduction

This chapter provides the second part of the literature review. It explores exercise and age considerations in relation to fall prevention interventions. To begin, the chapter looks at successful ageing, QOL and self-efficacy as they relate to the older adult. Ensuing discussion focuses on strategies to enhance self-efficacy applicable for use with exercise programs and looks at the few fall prevention interventions that have actively sought to build self-efficacy. The chapter concludes with an overview of factors affecting adherence to fall prevention programmes.

3.2 Quality of life

3.2.1 *Defining and measuring QOL*

Although ageing is often associated with declines in physical and psychological functioning (Berg, 1996), there has been a shift from ‘decline and loss models’ of older age to more constructive paradigms that emphasise QOL (Farquhar, 1995b). This has been accompanied by an increased interest in the constituents and enhancement of QOL in older age (Bowling et al., 2003).

QOL measures enable participants’ perspectives on the impact of health and health interventions to be assessed and considered in clinical decision making and research (Addington-Hall & Kalra, 2001). However, the literature highlights several important considerations related to the measurement and interpretation of QOL. First, lack of consensus as to the definition of QOL has complicated the development, use and interpretation of QOL measures (Vaapio, Salminen, Ojanlatva, & Kivela, 2008). Notably, QOL is a complex, multi-faceted term with multiple interpretations (Bowling, 1995; Bowling et al., 2003; Hass, 1999; Vaapio et al., 2008). In the biomedical and behavioural medicine literature, QOL outcomes commonly reflect physical, mental and social indicators of health. In the psychological literature, measures of QOL tend to capture a global sense of QOL or satisfaction with life (McAuley et al., 2006). Second, it has been argued that QOL is a highly individual concept and cannot be adequately assessed using standardised measures that ask every person the same questions and require responses to be

selected from a predetermined set (Higginson & Carr, 2001). Third, there is lack of clarity surrounding what constitutes an important change in QOL (and to whom is the change important)? For example, Lin et al. (2007) argued that meaningful interpretation of QOL scores is difficult, because statistical significance of change in scores implies little about the clinical significance.

Fourth, many QOL instruments combine information across several categories to provide aggregate measures. While these instruments offer simplicity of use, they are likely to be less sensitive. Whereas, treating QOL constructs as distinct from one another allows for the possibility of detecting benefits on some components and not others (Stewart & King, 1991). Finally, relatively little work has examined QOL in older populations (Hendry & McVittie, 2004). Because many QOL instruments have been designed for generic use, working class populations or particular sub-groups of patients (Vaapio et al., 2008), they may miss several items ranked by older people as important (Bowling, 2005). For example, studies demonstrate that the social dimension of QOL is important to older people. Yet the social dimension is almost totally lacking or measured too narrowly in many QOL instruments (Farquhar, 1995b; Lamb et al., 2005; Vaapio et al., 2008). For example, the Short Form 12-item Survey (SF-12) contains only one item related to the social dimension of QOL.

3.2.2 *Older people's views of successful ageing and QOL*

Ageing is often accompanied by concerns about functional ability, coping and independence (World Health Organisation, 1998). As people age, their ability to maintain independence, largely determines their QOL (World Health Organisation, 2002). For example, in a study of 194 elderly women, eighty percent said they would prefer death to a 'bad' hip fracture and subsequent admission to residential care. This group associated poor recovery of a hip fracture with QOL issues, including loss of independence, dignity and possessions (Salkeld et al., 2000).

Rowe and Kahn's (1998) widely used definition of successful ageing encompasses three components; avoiding disease, maintaining a high physical and cognitive function, and active engagement in life (including maintaining autonomy and social support). The findings from three key studies into older people's views of successful ageing are consistent with Rowe and Khan's definition. Phelan, Anderson, LaCroix and Larsen (2004) surveyed 4,566 people aged 65 years and older from Washington, America. Their participants provided a multidimensional definition of successful ageing encompassing; physical, psychological and social health. Kramer and De Jonge (1998) described similar findings from in-depth interviews with 20 persons aged 70 years and older. Respondents had a functionally oriented definition of successful ageing,

typified by the phrase ‘more or less being able to take care of yourself’. von Faber et al. (2001) interviewed 599 Dutch participants aged 85 years and older. Most of their participants viewed wellbeing, an aspect of psychological health, as equivalent to successful ageing. In von Faber et al.’s study, social functioning was considered essential and identified as the most important condition for wellbeing and successful ageing.

Bowling et al. (2003) and Bowling, Seetai, and Morris (2007) undertook qualitative studies to explore the older person’s priorities for a good quality of life. The former study surveyed British community dwellers 65 years and older. In that study good social relationships and health were identified as the most important aspects of QOL. Other important areas included; social activities, psychological outlook, wellbeing, and independence (Bowling et al., 2003). The latter study revealed that for older people with difficulties in physical functioning, higher social engagement and higher levels of perceived control were associated with better QOL (Bowling et al., 2007).

Overall, there appear to be several similarities between what older people identify as important elements of successful ageing and what they identify as important elements of QOL. Key among these is; physical function, social function, psychological function, control and independence. Hence, and as suggested by Bowling et al. (2003), it would seem that enabling people to retain their independence for longer is likely to enhance their QOL.

3.2.3 *Physical activity and QOL*

With advancing age there is increased susceptibility to a range of chronic conditions and functional disability, often resulting in compromised physical and psychological health and reduced QOL. However, research indicates that physical activity may be one of the most significant means by which individuals can influence their own health, attenuate functional decline, reduce the risk of disability (Department of Health Physical Activity Health Improvement and Prevention, 2004; Hirvensalo, Rantanen, & Heikkinen, 2000; Kesaniemi et al., 2001; Keysor, 2003; Larson, 1991; LIFE Study Investigators, 2006; Nelson et al., 2004) and maintain a high quality of life into older age (Miller, Rejeski, Reboussein, Ten Have, & Ettinger, 2000).

Several studies show associations between social activity, emotional health and quality of life (Department of Health Physical Activity Health Improvement and Prevention, 2004; Glass, de Leomn, Marottoli, & Berkman, 1999; Joyce, 2002; Kaplan et al., 1988; Lawton, Winter, Kleban, & Ruckdeschel, 1999) However, older people are more like to be at risk of social

isolation (Department of Health Physical Activity Health Improvement and Prevention, 2004). For the elderly, low levels of social activity, poor social support, poor social networks, and loneliness, have been linked to increased levels of depression, (Hraba, Lorenz, & Pechacova, 1997), lower feelings of self esteem and life satisfaction (Felton & Berry, 1992; Ishii-Kuntz, 1990), and greater likelihood of entering a nursing home (Russell, Cutrona, de la Mora, & Wallace, 1997).

The research associating social activity with QOL indicates that older people with low levels of social activity would benefit from increased socialisation (Hussain et al., 2005). While little is known about the potential of physical activity to enhance social outcomes (Department of Health Physical Activity Health Improvement and Prevention, 2004), positive social benefits have been observed in some exercise programmes for older people (Hardcastle & Taylor, 2001; Stathi, Fox, & McKenna, 2002). For example, Barlow, Williams and Wright (1999) found the group environment provided opportunities to meet and share concerns with similar others in a non-threatening socially supportive environment. Particular benefits have been associated with the reciprocal nature of interactions that came from taking part in exercise groups (2006). Ranzijn, Harford, and Andrews (2002) identified that for women in their study, exercise groups had formed an important part of their 'social glue' and provided a supportive space for sharing thoughts and feelings. Similarly, Iso-Ahola and Park (1996) described a buffer effect on stress through the social support received from friends and companions when taking part in leisure activities.

Although the impact of physical activity on mental health is a relatively new area of research, encompassing only a small number of high quality experimental studies, effects are consistent and plausible across a range of mental health outcomes (Department of Health Physical Activity Health Improvement and Prevention, 2004). Research findings confirm that physical activity can help improve the mental and emotional well-being of older adults. In particular, physical activity has been associated with; reduced symptoms of depression (Craft & Landers, Journal ; King, Taylor, & Haskell, 1993; Strawbridge, Deleger, Roberts, & Kaplan, 2002), reduced anxiety (Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991), enhanced mood (Arent, Landers, & Etnier, 2000), higher subjective well-being, self-esteem, life satisfaction and QOL (Biddle, 2000). Interestingly, the effects of exercise on mental health are likely to be more variable than those found in physiological change. Accumulated evidence indicates that factors associated with the process of being physically active, rather than fitness itself, are mainly responsible for the benefits in mental well-being. Important factors are likely to include the individual's subjective experience of the exercise and the setting in which it takes place (Department of Health Physical Activity Health Improvement and Prevention, 2004).

3.2.4 *Impacts of fall prevention interventions on QOL*

As discussed above, physical activity can impact many aspects of an older person's quality of life. Chapter 2 of this thesis described how advancing age brings increased susceptibility to falls (Campbell et al., 1981; Lord, Shambrook, & Gilbert, 1994; Lord et al., 1993). Most fall prevention interventions have been designed to minimise impairments affecting physical function, such as strength, balance and gait (Laybourne et al., 2008; Vaapio et al., 2008). Hence, assessment of their efficacy has traditionally focused on laboratory or clinical tests of physical parameters and rates of falls (Laybourne et al., 2008). However, fall prevention interventions can affect many aspects of a person's health, not just fall risk factors and falls (Lin et al., 2007; Lord, Sherrington, Menz, Close et al., 2007b).

There are several reasons why the traditional approach of measuring physical parameters and rates of falls may be too narrow. Firstly, it may not capture the multidimensional and highly variable responses that older people make to fall prevention exercise programmes (Laybourne et al., 2008; McInnes & Askie, 2004), responses which in themselves are likely to be a complex interaction between physical and psychosocial influences (McInnes & Askie, 2004). Secondly, assessing outcomes in terms of fall risk factors and falls may not fit with the priorities of older people and may miss more client focused trial outcomes (Ballinger & Clemson, 2006; Bunn, Dickinson, Barnett-Page, McInnes, & Horton, 2008).

Finally, assessment based on physical parameters and fall rates could limit the scope and outcomes of 'fall prevention' interventions. For example, QOL is considered to be the primary goal of treatment in the elderly population. Yet little is known about the effects of fall prevention programmes on the QOL of older people (Lin et al., 2007). Furthermore, by looking beyond 'fall prevention', health professionals may be more effective in promoting the health of older people (Ward-Griffin et al., 2004). In particular, including some of the broader determinants of health within 'fall prevention' programmes, could assist older people respond to the physical, social and psychological challenges of older age (Bowling et al., 2003).

Although, the importance of QOL and psychosocial outcome measures are increasingly being recognised in the field of fall prevention (Lamb et al., 2005; Vaapio et al., 2008), few fall prevention studies have reported a positive effect on QOL. Vaapio et al. (2008) conducted the only systematic review of fall prevention RCTs' which has assessed effect of the intervention on QOL. The authors identified twelve interventions. Six of these (three among community-dwellers and three in institutions) showed positive effects on some domains of QOL. All six reported improvements in physical function or physical health, social function, environmental

domain, vitality and mental health domains. The review identified only one fall prevention study that had been conducted among community-dwellers, involved an exercise component and had positively impacted domains of QOL. This study by Devereux, Robertson and Briffia (2005) investigated a water-based exercise and self-management programme in a small sample of persons from a population sub-group (50 persons with osteopenia or osteoporosis).

Based on the findings of their review Vaapio et al.(2008) recommended that future research consider the type of fall prevention interventions that effect QOL and the means by which they render an effect. In the context of fall prevention exercise programmes, understanding the mediators in the exercise programme-QOL relationship may assist the design of programmes to enhance QOL. However, this is likely to prove a challenge, given the major knowledge gaps concerning how generic exercise affects a variety of QOL domains in older adults (Elavsky et al., 2005; Stewart & King, 1991).

Vaapio et al. (2008) also suggested that both quantitative and qualitative methods be used to increase understanding of an interventions effect on QOL. Their recommendation is consistent with Bowling's (1995) finding that forced choice items produced different data to the open ended methods which had allowed participants to describe their experience. Hence, Bowling (1995) proposed that a qualitative approach may be one means of overcoming some of the shortfalls of standard QOL instruments.

Although not widely reported in the context of fall prevention, the use of proxies may provide another means to evaluate QOL outcomes. It is generally recognised that both healthcare professionals and lay caregivers can provide useful information, particularly on the more concrete, observable aspects of QOL (Addington-Hall & Kalra, 2001). Hence, it is plausible that qualitative methods which explore the views of health providers may extend understanding about the impact of fall prevention programmes.

3.3 Self-efficacy

As discussed earlier, most fall prevention research has targeted physical risk factors in an attempt to reduce falls. Considerably less attention has been given to fall related psychological factors (National Institute for Health and Clinical Excellence (NICE), 2004b) Yet, the psychological consequences related to falling, or the prospect of falling, may be as disabling, or sometimes more disabling than a fall itself (Cumming, Salked, Thomas, & George, 2000; Salkeld et al., 2000). Loss of confidence in mobility can lead to self-imposed restrictions in

physical activity, manifesting in decreased muscle strength, impaired balance and progressive functional decline, thereby reducing independence and increasing the risk of future falls. These, in turn, can impact an individual's perceived health and QOL (Bruce, Devine, & Prince, 2002; Cumming et al., 2000; Delbaere, Crombez, Vanderstraeten, Willems, & Cambier, 2004; Lach, 2002; Murphy, Williams, & Gill, 2002; Vaapio et al., 2008; Walker & Howland, 1991; Yardley & Smith, 2002).

Over time different constructs have been used to assess the psychological aspect of falling (Jorstad, Hauer, Becker, & Lamb, 2005; McAuley, Mihalko, & Rosengren, 1997; Rixt Zijlstra et al., 2007). In the early stages of research Tinetti and Powell (1993) described fear of falling as concern about falling that limited performance of everyday tasks. Such fear was generally thought to be a consequence of falls (Bhala, O'Donnell, & Thoppil, 1982; Shumway-Cook, Baldwin, Polissar, & Gruber, 1997). However, later research identified fear of falling in persons who had not fallen (Myers et al., 1996; Tinetti et al., 1988). According to Australian authors Kendig et al. (1996) approximately 30% of community-dwellers aged 65 years and over reported some degree of fear of falling, and around 10% reported severe levels of fear of falling.

Although often used interchangeably, recent research has compared the terms 'fear of falls' and 'fall related self-efficacy'. Moore and Ellis (2008), reported that while similar and related, they were in-fact unique constructs. Self-efficacy plays a definite role in fear of falls (McAuley et al., 1997). Yet when fall related efficacy and fear of falls were compared, fall related efficacy was an independent correlate of physical function and performance, whereas fear of falls was not (Gill, Williams, Williams, & Hale, 1998; Tinetti et al., 1994).

Self-efficacy, a concept based in the field of psychology, is derived from Bandura's Social Cognitive Theory (Bandura, 1977a; Bandura, 1986; Bandura, 1997). Self-efficacy describes an individual's perception of their capabilities with respect to a specific task. In the context of falls, self-efficacy is the belief in one's capabilities to carry out specific daily activities without falling (Tinetti, Richman, & Powell, 1990). Self-efficacy, together with outcome expectancies (belief that the behaviour will lead to a desired outcome) is thought to be a critical mediator determining which behaviours are attempted and how hard people try to adopt the behaviour before giving up (King et al., 1992).

Self-efficacy has been strongly associated with key performance measures such as balance and gait (Li et al., 2002; Myers et al., 1996; Tinetti & Powell, 1993). Higher levels of self-efficacy have been shown to be protective against functional decline in basic daily living activities and social activities (Tinetti et al., 1994; Tinetti & Powell, 1993). In turn, improved mobility, self-

care ability and sustained engagement in everyday activities have been associated with life satisfaction, greater independence and QOL (Bowling & Liffie, 2006; Li, Fisher, Harmer, & McAuley, 2003; Peterson et al., 1999; Stretton, 2006).

It is of concern that the self-efficacy of older people often changes in association with ageing, disability and illness (Bandura, 1997; Li et al., 2003). Older adults who have lower levels of self-efficacy tend to reduce the number of activities in which they engage (Bandura, 1997; Li et al., 2003; Tinetti et al., 1994; Tinetti & Powell, 1993) leaving them with fewer opportunities to experience successful efficacy-building behaviours, and leading to further decreases in efficacy (Bruce et al., 2002; Mendes de Leon, Seeman, Baker, Richardson, & Tinetti, 1995; Peterson et al., 1999; Seeman, Unger, McAvay, & Mendes de Leon, 1999). Increasing self-efficacy is therefore an important goal, not only to improve the psychological wellbeing of older people (Rixt Zijlstra et al., 2007) but to promote function and independence (Bowling & Liffie, 2006; Li et al., 2003; Peterson et al., 1999; Stretton, 2006; Tinetti et al., 1994; Tinetti & Powell, 1993). Hence, determining how older people maintain higher levels of self-efficacy (Bandura, 1997) and the extent to which compromised self-efficacy can be enhanced, are primary issues for research into ageing (McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003).

Several authors have recommended that prevention interventions for older adults at risk of functional decline and falling attempt to simultaneously improve physical function and confidence (Liu-Ambrose, Khan, Eng, Lord et al., 2004; National Institute for Health and Clinical Excellence (NICE), 2004b; Tinetti et al., 1994). Interestingly, the findings of several studies indicate that physical activity can have strong effects on functional ability and self-efficacy (Bandura, 1997; Elavsky et al., 2005; McAuley & Blissmer, 2000; McAuley & Katula, 1998; McAuley et al., 2006; Netz, Wu, Becker, & Tenenbaum, 2005; Seeman & Chen, 2002). McAuley et al (2006) hypothesised that for older adults whose self-efficacy may be deteriorating along with their functional abilities, physical activity could provide a mastery experience that leads to increased self-efficacy. This led McAuley et al. (2006) to recommend that physical activity interventions be structured to maximise growth in self-efficacy by targeting the primary sources of efficacy information.

The majority of exercise interventions that have enhanced balance confidence encompassed balance-training (Myers, Fletcher, Myers, & Sherk, 1998; Taggart, 2002; Wolf et al., 1996). According to Hatch and Gill (2003) 'fall related self-efficacy' and 'balance confidence' refer to the same construct of perceived balance ability (i.e. a person's level of confidence in their ability to maintain balance while performing specific daily activities). Yardley, Donovan-Hall, Francis, and Todd (2006) hypothesised that an emphasis on balance improvement would be

likely to increase confidence in balance, leading to a potentially beneficial effect on activity levels, physical functioning and fall risk factors.

Bandura's theory predicts that psychological interventions may be effective in enhancing self-efficacy for dealing with threatening situations (Bandura, Adams, & Beyer, 1977). Health programmes have increasingly incorporated health behaviour change, including strategies to enhance self-efficacy (Bandura, 1995; Nutbeam & Harris, 1998; Strecher, McEvoy, Vellis, Becker, & Rosenstock, 1986). Moreover, exercise studies that have focused specifically on self-efficacy have reported positive associations in both clinical and health populations (Ewart, Taylor, Reese, & DeBusk, 1983; King et al., 1992).

Although little researched, cognitive behavioural approaches may be used to change attitudes and behaviours in an attempt to reduce fall risk (Cheal & Clemson, 2001; National Ageing Research Institute, 2004). At this point, there is no evidence that cognitive behavioural interventions in isolation reduce the incidence of fear of falls in community-dwelling older adults of unknown risk (National Institute for Health and Clinical Excellence (NICE), 2004a). However, an RCT by Tennstedt, Howland, and Lackman (1998) investigated a cognitive-behavioural intervention, incorporating cognitive restructuring and skill training, with the intention of increasing self-efficacy and sense of control over falling. Results indicated that short-term changes could be achieved in maladaptive attitudes and beliefs about self-efficacy, activity levels and falling. A more recent RCT by Clemson et al. (2003) used a small group learning environment with the intention of encouraging behaviour change, improving self-efficacy and reducing falls. Their programme successfully reduced the risk of falling and improved self-efficacy in everyday tasks.

The studies by Clemson et al. (2004) and Tennstedt et al. (1998) support the use of a cognitive behavioural approach in fall prevention interventions. Interestingly, both studies were multi-component interventions which included an exercise programme. As previously discussed, earlier research shows that physical activity can have strong effects on functional ability and self-efficacy. Therefore, and as suggested by Stretton (2006) and Tennstedt (1998), it is possible that a combination of physical and mental training strategies, such as physical conditioning, mastery experiences and cognitive restructuring, may maximise benefits regarding balance and control of functional mobility.

3.3.1 *Efficacy building strategies*

As previously noted, self-efficacy beliefs can be changed and thus represent a useful target for intervention (King et al., 1992). However, few fall prevention studies have actively incorporated efficacy-building strategies. This section outlines key efficacy building strategies identified in the literature, which may be applicable for use with fall prevention exercise programmes (Bandura, 1986; Bandura, 1997; Bhala et al., 1982; Strecher et al., 1986; Tinetti et al., 1994).

Self-mastery

Bandura (1995) proposed that the most important factor in building a strong self-efficacy was the experience of mastery in everyday activities. According to Social Cognitive Theory, persistence in activities that are subjectively threatening (even if relatively safe), through experiences of mastery, leads to enhancement of self-efficacy (Bandura, 1986). In the context of fall prevention, the experience of performing activities safely may lead to greater fall self-efficacy (Rixt Zijlstra et al., 2007).

Several techniques have been recommended to facilitate the success of a mastery experience. First, practice should ideally take place in real life circumstances (Bandura, 1995). Second, because personal accomplishments are important, it may be helpful to begin training with simple tasks or break skills down into more easily mastered sub-skills. Accomplishments on these tasks would build efficacy and enable the individual to attempt more complicated tasks (Clemson et al., 2003; Tinetti et al., 1994). Third, goal setting and attainment can act as an intrinsic motivator, increasing a person's confidence in their ability to be physically active and encouraging them to attempt more complicated tasks (Lorig, 1986; McNeill, Wyrwich, Brownson, Clark, & Kreuter, 2006; Tinetti et al., 1994). Last, regular exercise participation can act as a powerful source of efficacy information (Bandura, 1997; McAuley et al., 2003). Therefore opportunities for practice, possibly via homework, are likely to be beneficial (Lorig, 1986).

Australian Occupational Therapists Beth Cheal and Lindy Clemson (2001) evaluated the 'Steady-As-You-Go' programme of supervised outdoor excursions to promote fall self-efficacy. Their group programme highlighted the value of using self-mastery experiences, skill development and verbal support as techniques to promote safety in community mobility tasks. Participants rated the outdoor experiences as being the most useful aspect of the programme.

Verbal persuasion

Positive yet realistic feedback from facilitators and peers, focusing on true ability and successful performance, may encourage people to try harder and promote self-efficacy (Bandura, 1986;

Bandura, 1997; Clemson et al., 2003; Rejeski & Mihalko, 2001; Strecher et al., 1986). Feedback which identifies participant accomplishments (praise for goal progressions) and enhances self-efficacy perceptions relative to specific outcomes may be especially beneficial (Bandura, 1986; Bandura, 1997; Strecher et al., 1986).

Witnessing others

Efficacy is thought to be influenced both by one's own experience and witnessing the experience of others (Bandura, 1982; Strecher et al., 1986). Group work exposes participants to potential role models. Observing others engaging in the behaviour and noting the consequences, can impact how personal capabilities are appraised (Bandura, 1986; Clemson et al., 2003). For best effect, the role model should have similar characteristics and be in similar circumstances to the observer. The models should be seen to overcome difficult situations with determined effort rather than ease, and be shown to have a rewarding outcome (Bandura, 1977a; Tinetti et al., 1994).

Social support and the affective experience of the exercises

Bandura (1997) identified the social network and social support created within the exercise group as important correlates of exercise behaviour. Individuals use information about their physiological and emotional states to judge their capabilities (Bandura, 1997; Clemson et al., 2003). This information can either, help to strengthen or weaken perceptions of capabilities, and in turn, influence subsequent behaviour (Bandura, 1997). Pleasant experiences can heighten beliefs about coping, whereas stress and agitated states are not conducive to growing self-efficacy and personal accomplishment (Clemson et al., 2003).

A person may experience reduced negative affect and enhanced positive affect (feeling states) through exercise (Allegrante & Marks, 2003; Elavsky et al., 2005; McAuley & Katula, 1998; O'Leary, 1985), as indicated by statements such as, 'exercise makes me feel good'. Positive effect may also be promoted by minimising physical pain associated with exercise (Lees, Clark et al 2005). In addition, a participant might experience positive or negative affect via the group environment, as indicated by statements such as, 'being part of the group is fun' (McAuley et al., 2003).

Findings of the Clemson et al. (2003) study, discussed in section 3.3, highlighted the affective experience of the exercises as an important aspect of the 'Stepping On' programme. Many 'Stepping On' participants commented they thought they were improving with the exercises, because they felt stronger or their balance was better. Participants also reported being better able to do specific activities and this had provided motivation for them.

3.3.2 *Measurement of self-efficacy*

Performance data and self-efficacy can serve as an important part of programme planning and evaluation (Lusardi & Smith Jr, 1997). Because self-efficacy is situation specific (Bandura, 1997), the assessment of self-efficacy needs to be behaviourally specific and individualised to a specific domain of function (Maibach & Murphy, 1995). The 2005 ProFaNE consensus attempted to standardise outcome data of fall related measures for fall prevention trials. This consensus recommended conceptualising psychological consequences of falls in terms of a fall related self-efficacy measure based in the Social Cognitive Theory (Lamb et al., 2005).

3.4 Adherence

Although the usefulness of balance-training exercise programmes has been demonstrated, their effectiveness in reducing rates of falls is dependent on rates of uptake and adherence (Campbell et al., 1997; Day et al., 2002; McInnes & Askie, 2004; Nitz & Choy, 2004; Nolan, 2008; Todd & Skelton, 2004; Yardley, Bishop et al., 2006; Yardley, Donovan-Hall et al., 2006). However, subject compliance is the most commonly reported barrier to successful fall prevention interventions (Fortinsky et al., 2004). Typically less than half of community-dwellers invited to participate in fall prevention interventions take up the offer (Campbell et al., 1997; Robertson, Devlin, Scuffham et al., 2001), with uptake as low as 10% (Day et al., 2002; Stevens, Holman, Bennett, & de Klerk, 2001). Then there is attrition through dropout and non-adherence (McInnes & Askie, 2004; Yardley, Bishop et al., 2006).

Predictors of adherence could provide important information to assist the design of programmes that maximise acceptability, uptake and adherence (Bunn et al., 2008; McInnes & Askie, 2004; National Ageing Research Institute, 2004; Nolan, 2008; Sjosten et al., 2007; Ward-Griffin et al., 2004; Yardley, Donovan-Hall et al., 2006). However, fall prevention trials and systematic reviews typically provide little information on participants' expectations of, or views about the intervention (Ballinger & Clemson, 2006; McInnes & Askie, 2004). Consequently, little is known about the acceptability and perceived barriers to fall prevention programmes (Ballinger & Clemson, 2006; McInnes & Askie, 2004; Sjosten et al., 2007). Thus, research is required to identify individual and environmental factors which facilitate uptake and sustained engagement in fall prevention exercise programmes (National Ageing Research Institute, 2004). The National Institute of Clinical Excellence (NICE) (2004a), reviewed the comparatively few quantitative and qualitative studies which examined older people's views on a range of fall prevention interventions. Their review, which comprised 24 studies conducted between 1990

and 2003, found that most of the studies had investigated subject's views independent of a trial. According to NICE, had the studies been conducted concurrently, as part of a trial, the results might have been different.

3.4.1 *Facilitators and barriers to participation in fall prevention programmes*

An array of factors has been associated with exercise adherence (Williams & Lord, 1995). The following section discusses factors commonly mentioned in the literature and likely to have implications for fall prevention exercise programmes.

Health and perceptions

General good health and functional ability increased participation and were strong predictors of adherence in fall prevention interventions (Ballinger & Clemson, 2006; McInnes & Askie, 2004; Sjosten et al., 2007). Conversely, poor health was the most often mentioned barrier to participation (Clark, 1999; Rasinaho, Hirvensalo, Leinonen, Lintunen, & Rantanen, 2006). Poor health either directly prevented participation, or indirectly prevented it due to concerns about the suitability of the exercise in relation to the individual's physical ability or anxiety about the consequences (McInnes & Askie, 2004; Nolan, 2008; Simpson, Darwin, & Marsh, 2003; Yardley, Donovan-Hall et al., 2006). Specific barriers to exercise included; injury, chronic illness, co-existing disease state, mobility limitations, unpleasant sensations associated with exercise, and fear of falls (Clark, 1999; Grossman & Stewart, 2003; Hill et al., 1996; Lees, Clark, Nigg, & Newman, 2005; Marks & Allengrante, 2005; Morey, Pieper, & Cornoni-Huntley, 1998; Rasinaho et al., 2006). For example, a prospective participant may fear their pain may be 'so bad' it would prevent them exercising or that exercising might 'bring on' their pain. Alternatively, they may perceive exercise would require 'too much' effort or would lead to them being exhausted (Simpson et al., 2003). As discussed earlier, based on Bandura's theory, aches and pains associated with activity can impact self-efficacy, which may have implications for motivation and adherence (see section 3.3.1) (Bandura, 1997; McAuley, Lox, & Duncan, 1993; Resnick & Spellbring, 2000). In the light of these concerns, it is perhaps not surprising that exercise of low to moderate intensity and moderate frequency has been found to boost adherence (2004).

Overall, it seems that opportunities for primary or vicarious experiences that address environmental and physiologic barriers may be important in increasing self-efficacy (Simpson et al., 2003). Furthermore, people with pain or mobility limitations may need to be convinced about the safety of exercise activities and the exercise environment, and might benefit from

support, for example a volunteer escort, when undertaking a new exercise (Leveille, Cohen-Mansfield, & Guralnik, 2003).

In terms of facilitators, maintaining health is the most often reported motivator to exercise among older people (Rasinaho et al., 2006). Exercise programs perceived by participants as relevant and beneficial to their needs, showed higher attendance (Bunn et al., 2008; McInnes & Askie, 2004; Stead, Wimbrush, Eadie, & Teer, 1997). Once seniors started an exercise programme the realisation of physical improvements were motivating factors to continue (American Council on Exercise, 1998). Furthermore, many older adults use exercise as a means to counter functional deficits or prevent the onset of disability (Muse, 2005).

In general, older people's beliefs about exercise and the benefits of exercise influenced their motivation to exercise. For example, a lack of knowledge about the benefits of exercise, on the part of the older adult, was a known cause of inactivity (Dishman, 1994; Mann, Pruitt, Meehan, & Kemper, 1997; Resnick & Spellbring, 2000). In the context of fall prevention, participation was increased by having previous experience with exercise (Yardley, Donovan-Hall et al., 2006). Whereas, Simpson et al (2003), interviewed 32 community-living older adults. They found that most were unaware of the benefits of exercise in general or the positive effects of specific exercise on balance and strength, and showed little inclination for taking it up.

Inconvenience

The accessibility of a programme can affect adherence. For example, participation may be influenced by convenience and the availability of adequate transport (Bunn et al., 2008). Adherence may also be adversely impacted by onerous requirements in terms of time, effort and cost (Simpson et al., 2003; Vaapio et al., 2008; Yardley, Donovan-Hall et al., 2006).

Enjoyment and social aspects

As previously discussed social function is especially important for older people, to the extent that they consider social contacts to be as valuable a component of QOL as health itself (Farquhar, 1995a). Ironically, by restricting movement and avoiding activities, older people often miss opportunities to engage in social networks (Ward-Griffin et al., 2004).

Enjoyment, fun, social contact and social support have been identified as powerful motivators for older adults to exercise (Ballinger & Clemson, 2006; Hardcastle & Taylor, 2001; Kirkby, Kolt, Habel, & Adams, 1999; Paxton, Browning, & O'Connell, 1997; Stathi et al., 2002). Exercise groups can increase opportunities to interact, form new friendships and develop social networks (American Council on Exercise, 1998), all of which may be important for older people

at risk of loneliness and social isolation (McMurdo, 2000). Some fall prevention interventions have shown that social interaction and support promoted uptake and adherence (Ballinger & Clemson, 2006; McInnes & Askie, 2004; Sjosten et al., 2007; Stead et al., 1997; Yardley, Bishop et al., 2006). A recent systematic review by Bunn et al. (2008) corroborated that the majority of older adults preferred fall prevention interventions with interaction and strong social support. Moreover, several authors have recommended that fall prevention interventions include a social component. They contend that providing a pleasant social environment, attending to and building on opportunities for enjoyment, camaraderie, problem solving and building positive social identities, may make interventions more relevant and attractive to older people, thereby enhancing uptake, adherence, and ultimately effectiveness (Ballinger & Clemson, 2006; Barlow et al., 1999; Bunn et al., 2008; McInnes & Askie, 2004; Yardley, Bishop et al., 2006).

Independence

Independence is a highly valued asset for older people (Hughes et al., 2008). Thus older adults are likely to be motivated by anything that enables them to remain independent, free and in control (Commonwealth Department of Health and Aged Care [Marketing Consultancy Network Inc], 2000). For example, Hughes et al. (2008) explored eight focus groups of persons 70 years and over, and found messages that emphasised independence or health were favoured over fall related messages. Moreover, older people welcomed fall prevention exercise programmes, because they saw them as a means of maintaining control and independence (Commonwealth Department of Health and Aged Care, 2001; Stead et al., 1997; Yardley, Donovan-Hall et al., 2006). For example, Yardley and Bishop et al. (2006) found that physical benefits of fall prevention programmes were implicitly and sometimes explicitly linked with independence. Similarly, participants of the Clemson et al. 'Stepping On' programme (2003) spoke of the programme as an insurance against future frailty and impairment.

Overall benefits

According to Ballinger et al. (2006) and NICE (2004a) mismatches may occur between the agendas of older people and those of health professionals. For example, the majority of fall prevention interventions have been presented exclusively as a means to reduce falls, rather than interventions with the potential to offer a wider range of benefits. Yet, the life enhancing aspects of fall prevention programmes have been widely reported as reasons for adherence (McInnes & Askie, 2004; Yardley, Bishop et al., 2006).

This literature review highlighted that work is needed to increase uptake and adherence to fall prevention exercise interventions. Generic exercise studies and a limited number of fall prevention studies point to the benefits of interventions that remove the perceived barriers and

support the motives of older adults to engage in fall prevention programmes. To this end it is important that programmes be realistically achievable, acceptable and accessible for participants. Uptake and adherence may also be promoted by emphasising the life enhancing aspects of fall prevention programmes, such as enjoyment, social functioning, confidence, benefits for health, managing in ADL, maintaining control and independence (McInnes & Askie, 2004; National Institute for Health and Clinical Excellence (NICE), 2004a; Vaapio et al., 2008; Yardley, Donovan-Hall et al., 2006).

3.4.2 Ongoing participation

American Kinesiologist Rod Dishman and Exercise Psychologist Janet Buckworth (Dishman & Buckworth, 1996) conducted a meta-analysis of 127 studies on physical activity across a range of community settings. They found that few individuals maintained a physical activity after conclusion of an intervention, and pointed to the need for sustained or repeated implementation of interventions. In the context of fall prevention, interventions must be sustained if they are to be of ongoing benefit (Todd & Skelton, 2004). However, the provision of interventions must also be balanced with resource availability. Therefore, when contemplating fall prevention exercise interventions as a preventative strategy, it is important to bear in mind that there are many older people in the community. Due to the limitations of available health services, we can only provide a certain amount of attention to each individual over an extended period (Arai et al., 2007).

In light of the finite availability of health resources, it has been suggested that once fall prevention classes or supervised sessions are complete, ongoing participation may be promoted by; telephone calls, home visits and booster sessions (Campbell, Robertson, Gardner, Norton, & Buchner, 1999a; Sjosten et al., 2007; Tennstedt et al., 1998).

3.5 Summary

Older adults identify important components of successful ageing and QOL as good physical, social, and mental function, together with control and independence. Health and QOL may be compromised by the ageing process, threat of falls, or experience of falling. However, there is convincing evidence that physical activity is effective in promoting physical and social function, mental health and independence in older age. While fall prevention interventions have been shown to influence many aspects of a person's life and positively affect QOL, research is

required to determine the type of fall prevention interventions that effect QOL and means by which they impact QOL.

The self-efficacy of older people typically changes in association with ageing, disability and illness. Lower levels of self-efficacy have been associated with functional decline, impaired social function and decreased QOL. Although few fall prevention interventions have actively incorporated efficacy-building strategies, the application of these strategies has the potential to positively impact outcomes.

Research has identified an array of personal, programme and environmental variables that influence uptake and adherence to physical activity. However, relatively few studies have explored these variables in the context of fall prevention interventions. With reference to the limited evidence-base, it seems that many of the reported benefits of fall prevention programmes are consistent with what older people identify as important elements of QOL and successful ageing. Designing fall prevention programmes to maximise these benefits may promote uptake and adherence.

CHAPTER 4: MIXED METHODS RESEARCH

4.1 Introduction

Chapters 2 and 3 reviewed literature on the problem of falls and discussed considerations relevant to the design and implementation of fall prevention interventions. This chapter overviews mixed methods research. It defines and traces a brief history of the mixed methods approach. Strengths and limitations of mixed methods designs are considered. The chapter concludes by discussing the use of mixed methods research in health and evaluation contexts.

4.2 Mixed methods research

The Journal of Mixed Methods Research defines mixed methods research as:

...research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or program of inquiry (Sage Research Methods Online, 2011).

According to Tashakkori and Teddlie (2003a) researchers can be roughly categorised into three groups: (a) quantitatively-orientated researchers working within the post-positivist tradition and primarily interested in numerical analysis, (b) qualitatively-orientated researchers working within the constructivist tradition and primarily interested in narrative data, and (c) mixed methodologists working within other paradigms and interested in both types of data. Mixed methods research assumes that quantitative and qualitative research methods constitute complimentary not mutually exclusive strategies for research.

4.2.1 Tracing the history of mixed methods

Although, social scientists have been mixing methods for decades, over the past decade, mixed methods has come to be recognised as a distinct research methodology (Creswell, 2003). This recognition has been accompanied by an evolution of the procedural guidelines for mixed methods including; the specification of design types, notation systems and visual models (Creswell, Plano Clark, Gutmann, & Hanson, 2003). The past decade has also witnessed a marked growth in the popularity of using mixed methods, as evidenced by the proliferation of

research texts, papers, dedicated conferences, special edition journals and a journal of mixed methods research (Creswell, 2003; Tashakkori & Teddlie, 2003a).

4.2.2 *Strengths of mixed methods research*

Human participants and their activities are complex and challenging to understand (Greene & Caracelli, 2003). Quantitative methods make it possible to measure the responses of large numbers of people. The data are systematic and standardised, thereby offering a broad generalisable set of results. By contrast, qualitative findings usually produce detailed information which increases the depth of understanding but limits generalisability (Patton, 2002). Qualitative measures convey the context for interpreting statistical outcomes and illuminate dimensions of desired outcomes that are difficult to quantify. They show the human faces behind the numbers and assist in understanding whether the numbers represent meaningful changes in the lives of participants (Patton, 2002).

The aim of mixed methods approaches is to draw from the strengths and minimise the weakness of both quantitative and qualitative methods (Creswell, 2003; Johnson & Onwuegbuzie, 2004). The central premise is that combining approaches provides a better understanding of the research problem than either approach alone. In essence, mixing methods provides potential for a) greater depth, detail and clarity, b) inferences that are more valid and credible, and c) understandings that are broader, deeper and wiser (Greene & Caracelli, 2003; Rallis & Rossman, 2003).

4.2.3 *Limitations of mixed methods research*

Despite its value, mixed methods research is inherently more complex and poses many potential challenges to the researcher (Creswell & Plano Clark, 2007; Forthofer, 2003; Rallis & Rossman, 2003; Streubert Speziale & Carpenter, 2007). It necessitates the researcher be familiar with both quantitative and qualitative enquiry or work as part of a multi-skilled team (Creswell & Plano Clark, 2007). Mixed methods design requires additional resources and time for design, implementation and analysis (Creswell & Plano Clark, 2007; Forthofer, 2003; Rallis & Rossman, 2003; Streubert Speziale & Carpenter, 2007). However, these difficulties are not insurmountable, and the value of mixed methods research has the potential to far outweigh the challenges (Creswell & Plano Clark, 2007; Tashakkori & Teddlie, 2003a).

4.2.4 *Mixed methods in the health sciences*

The evolution of methodological approaches in the social and behavioural sciences, from single method approaches to mixed methods approaches, has paralleled an evolution in the foci of health research (Domholdt, 2005). In response to increasing recognition that a variety of factors affect health (O'Cathain & Thomas, 2006), practitioners have begun to focus on biopsychosocial models of care, rather than disease-based biomedical models. At the same time there has been a shift in emphasis towards adapting health care delivery to meet patient needs (Forthofer, 2003).

Increasingly, methods of the social and behavioural sciences, including mixed methods, have been applied to capture the complexity of both the factors affecting health and new models of health care (Domholdt, 2005; Forthofer, 2003; Moran-Ellis, Alexander, Cronin, Dickinson, & Fielding, 2006; O'Cathain & Thomas, 2006). Furthermore, health researchers have been inclined to mix methods, to address complex research topics where study aims relate to both pure research and applied use in clinical settings (Morgan, 1998).

4.2.5 *Mixed methods in evaluation contexts*

Combining methods has a longstanding history in the field of evaluation (Rallis & Rossman, 2003). Evaluation studies investigate activities, characteristics and outcomes of programmes to improve programme effectiveness and inform decisions about future programming (Patton, 2002). Programme evaluation may be divided into process and outcome evaluation. Process evaluation focuses on how something happens and seeks to understand various aspects of a programme. For example, what features of the programme make a difference? Outcomes evaluation looks at outcomes, with a view to providing concrete patterns of effectiveness (Patton, 2002). For example, will the intervention achieve the desired outcome?

4.3 Summary

Mixed methods research involves integrating quantitative and qualitative data collection and analysis in a single study or programme of enquiry. The underlying logic of mixing is that neither quantitative nor qualitative methods alone capture the trends and details of a situation. When used in combination, quantitative and qualitative methods provide a more complete analysis, and compliment each other.

Mixed methods have been used extensively in health and evaluation contexts. Listening to the participant's voice conveys their actual experience and provides important insights into how to

implement an effective intervention. Mixed methods can be used to investigate both process and outcomes, thereby assisting understanding of an intervention's application and efficacy.

PART B

THE METHODOLOGY

Chapter 5: The Methodology and Research Design

Chapter 6: Methods of the Randomised Controlled Trial

Chapter 7: Methods of the Embedded Qualitative Study

CHAPTER 5: THE METHODOLOGY AND RESEARCH DESIGN

5.1 Introduction

The primary aim of the present study was to examine the relationship between participation in the exercise programme and measures of fall risk factors. This aspect of the research addressed the question; ‘Will a balance-training exercise programme significantly reduce fall risk factors for community-dwelling rural older people?’ The secondary purpose was to explore programme processes and outcomes. This latter aspect of the research addressed the question; ‘What were the programme’s processes and outcomes?’

Chapter 4 provided an overview of mixed methods research. This chapter describes the application of a mixed methods model to the present study (RCT and embedded study). It outlines the study design, focussing on elements common to both the RCT and embedded study. Details of the study setting, participants and implementation are provided. Next, consideration is given to the intervention, outcome measures, data management and analysis. The chapter concludes with a discussion of the researcher’s background and position in the study. Later chapters explain methods related specifically to the RCT (Chapter 6) and the embedded study (Chapter 7).

5.2 Application of mixed methods to the study

5.2.1 *Reasons for using mixed methods*

The research questions, outlined in Chapter 1, were intended to provide a comprehensive understanding of the exercise programme, its implementation and outcomes, thereby assisting with future programming. It was anticipated that the research questions would be best answered through the use of a mixed methods approach. The research design was selected to promote expansion, that is, to extend the scope, breadth and range of the enquiry (Rallis & Rossman, 2003). The first research question sought to determine the effectiveness of the intervention. Bradham (1994) describes effectiveness as the extent to which benefits of a health care intervention achievable under optimal conditions of care are actually achieved in clinical practice. In this case, did participation in the exercise programme have an effect on fall risk factors? This question was answered by statistical analysis of data gathered in the RCT.

The second research question sought to explore processes and outcomes of the intervention. To answer this question, a qualitative study was embedded within the RCT. The embedded study was intended to capture participant and provider views, thereby adding depth to our understanding of the programme (Patton, 2002). According to Denzin: "...the perspectives and experiences of those persons who are served by applied programs must be grasped, interpreted, and understood if solid, effective, applied programs are to be put into place" (Denzin, 1978b, p. 105).

5.2.2 *The embedded experimental model*

Numerous models have been described for combining methods (Creswell & Plano Clark, 2007; Tashakkori & Teddlie, 2003a). The present study used the 'embedded experimental model' as described by Creswell and Plano Clark (2007) (Figure 5-1). A defining feature of their model is that it locates qualitative methodology within an experimental design. Their model was selected based on it being well suited to the study's purposes and setting. Consistent with Creswell and Plano Clark's model (2007), overall findings of the present study were based on interpretation of both the quantitative results and qualitative findings.

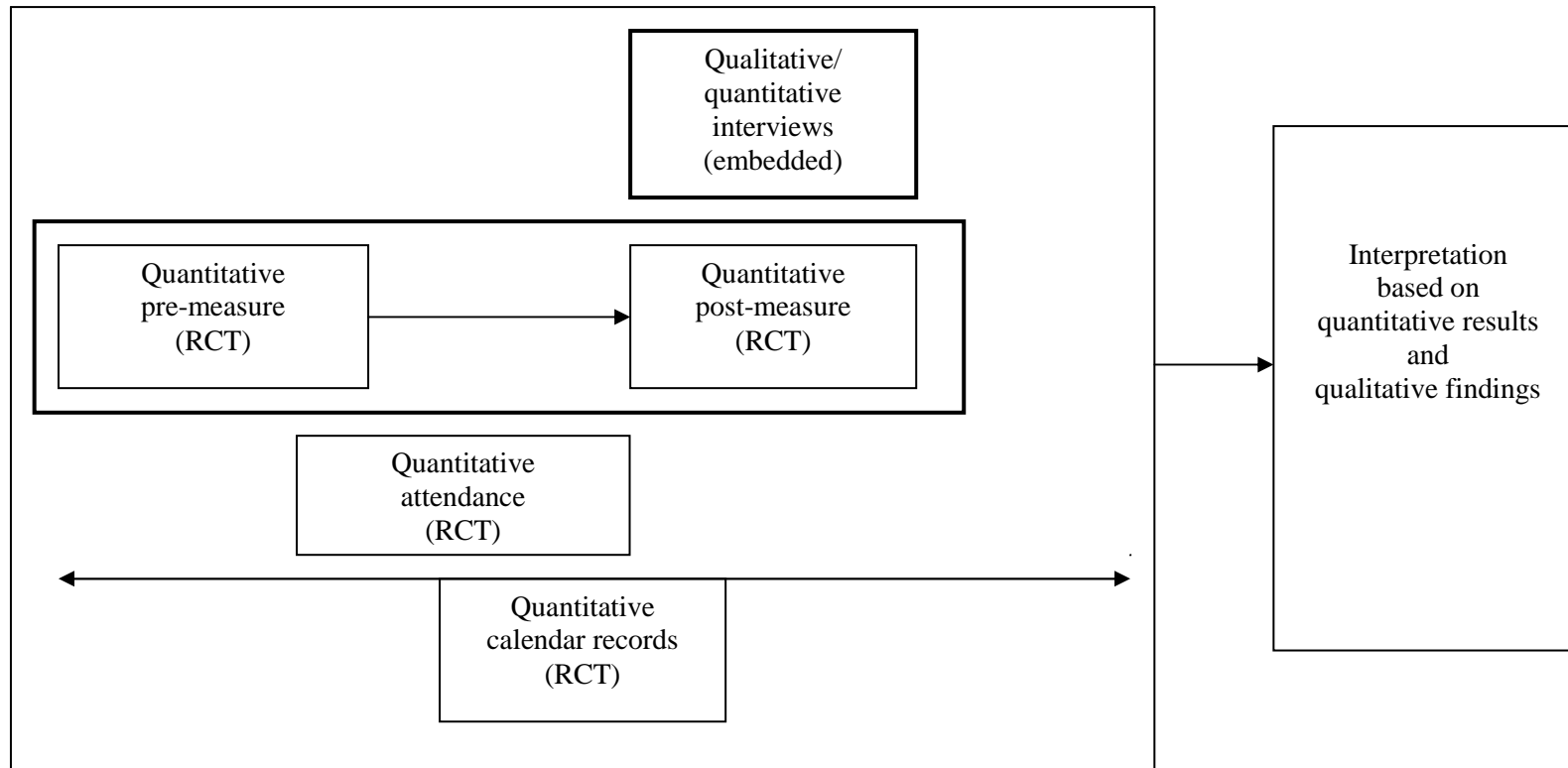


Figure 5-1: Model of the overall study.

5.2.3 *Priority*

The embedded experimental model stipulated that priority be established by the quantitative experimental methodology and that the qualitative data set was subservient within that methodology. Accordingly, the RCT formed the analytic core and the embedded study augmented that core, adding insights and explanation to the findings of the core (Morse, 2003). Thus, the ‘theoretical drive’ of the overall research study was deductive, and the method used was quantitative. However, in conducting the embedded study, the direction became inductive and the method used was qualitative.

5.2.4 *Implementation of the methods*

In terms of mixed method designs, implementation refers to the sequence used to collect the quantitative and qualitative data (Creswell et al., 2003). For this study, data collections were essentially simultaneous. Some data were gathered at baseline and at specific points over a one year period. However, the follow-up RCT assessments and interviews were undertaken during the same time period, that is, in the week following cessation of the exercise classes. This approach offered several advantages. Firstly, it fitted logistic and resource constraints; secondly, physical measures were reflective of participant’s physical status at completion of the programme; and lastly, this timeframe promoted accurate recall.

5.2.5 *Integration*

There are elements of integration throughout the study. For example, at the stage of data collection, the interviews combined closed and open-ended questions to collect both quantitative and qualitative data in a single instrument (Creswell et al., 2003). However, in the main, the data generated by the two methods were essentially kept separate until the point of interpretation Figure 5-1. At that stage, findings from the RCT and embedded study were brought together and linked. The final inferences (Tashakkori & Teddlie, 2003b) are presented in Chapter 10 of this thesis.

5.2.6 *A pragmatic approach*

Definitions of ‘quantitative’ and ‘qualitative’ have long been associated with different paradigmatic approaches to research, that is, different assumptions about the nature of knowing (ontology) and the means of generating it (epistemology) (Bazeley, 2002). Despite widespread acknowledgement that multiple paradigms may be associated with the use of mixed methods (Creswell & Plano Clark, 2007), the paradigmatic issues raised by mixed methods remain

unresolved (Bazeley, 2002; Creswell & Plano Clark, 2007). In the present study a pragmatic approach was adopted, which sidestepped philosophical debates and allowed methods to be mixed to address different research questions (O'Cathain & Thomas, 2006; Richards & Morse, 2007). Pragmatism is the worldview typically associated with mixed methods (Creswell & Plano Clark, 2007). It supports the use of both quantitative and qualitative data in the same study (Tashakkori & Teddlie, 2003a). Pragmatism focuses on 'what works' (O'Cathain & Thomas, 2006) in practice and the consequences of the research (Creswell et al., 2003). Accordingly, the research question is of fundamental importance (Johnson & Onwuegbuzie, 2004) and more important than either the method or paradigm that underlies the method (Tashakkori & Teddlie, 2003a).

5.3 Overview of the study

The study presented in this thesis investigated the processes and outcomes of a single exercise intervention delivered in a real-life clinical setting by usual health professionals across a number of settings. Based on the researcher's clinical experience, discussions with physiotherapy clinicians and the literature review, the exercise programme incorporated components anticipated to be effective in reducing fall risk factors. The intervention was designed to be low-cost and suitable for implementation in the specified rural context. To assist the reader's understanding of the overall research design, a summary of the research framework is presented in Table 5-1.

Table 5-1: An overview of the research framework

Components of quantitative data collection:

Participants randomised to intervention group (IP) and control group (C)
Participants attended a baseline and post intervention assessment (IP & C)
Records of attendance at exercise classes (IP)
Participants completed monthly self-report calendars (IP & C)
Closed-ended interview questions for participants (IP), physiotherapists and volunteer assistants (post intervention)

Components of qualitative data collection:

Post intervention open-ended interview questions for participants (IP), physiotherapists and volunteer assistants

Data analysis:

Quantitative data were analysed by descriptive statistics, logistic regression and mixed models analysis
Qualitative data were interpreted using a modified grounded theory approach (see Chapter 7)

Discussion and inferences:

Quantitative results and qualitative findings are discussed jointly in the final section of the thesis. Significant factors identified by quantitative analysis are corroborated with the themes and starting grounded theory that emerged from the interviews. Inconsistencies and areas of overlap are discussed. Consideration is given to the additional insights provided by the qualitative analysis

Priority: Quantitative

Sequence: Quantitative+ qualitative simultaneously

Integration: Primarily at inference stages (also questions and data collection)

Strengths:

Combining methods of data collection and analysis allowed for a deeper and broader understanding of the exercise programme. Practical contributions and directions for future research were identified

Weakness:

As it was a more complex design, it was more time and resource intensive

5.4 Study setting

The study was conducted at five rural centres (sites) within the Hunter-New England Area Health Service (HNEAHS) of New South Wales (Figure 5-2). HNEAHS provides care for approximately 840,000 people (12% of the NSW population). It covers a geographical area of approximately 130,000 square kilometres-the size of England (Hunter New England Area Health Service, 2005). Assessments and programmes were conducted in the physiotherapy department of the public hospital at each site. The programme was delivered by four HNEAHS physiotherapists (spoke sites) and the researcher (hub site). For many rural communities, the hospital has been the major institution for health care provision (Humphreys, 2002). Hence, hospitals were selected as the delivery point for the present intervention.



Figure 5-2: Map showing the location of the HNEAHS within NSW and the study sites within the HNEAHS

5.4.1 Selection of the study sites

The programme was implemented using a ‘hub-and-spoke’ model of service delivery. In rural Australia, outreach services are often delivered using a ‘hub-and-spoke’ model, whereby services are routed through a central hub to their respective target areas (spokes) (Wakerman et al., 2006). The researcher was located in Tamworth. To facilitate efficient use of resources Tamworth was selected as the hub site. Distance was the principle eligibility criteria for the spoke sites. To ensure feasibility of inclusion, given available resources, spoke sites were

required to be located within 250km from Tamworth. Spoke sites were determined by calling for expressions of interest from physiotherapists at an area wide HNEAHS physiotherapist meeting. Four physiotherapists volunteered to participate in the study. All were located within the specified geographical parameters and, subject to management approval, were accepted as sites in the project.

5.4.2 *Site demographic and socioeconomic characteristics*

The sites varied in demographic and socioeconomic characteristics. Table 5-2 provides an overview of these characteristics. For example, population sizes ranged from small towns to a rural city. The overall variation between sites was considered reflective of real-life rural clinical settings and likely to enhance the external validity of the research.

The past two decades have seen the development of geographical classifications for Australia that describe areas in terms of relative remoteness (Australian Institute of Health and Welfare, 2004). Two of the major classification systems are; Rural Remote and Metropolitan Areas (RRMA) and Accessibility/Remoteness Index of Australia (ARIA) (Australian Institute of Health and Welfare, 2004; Wakerman & Humphreys, 2008). RRMA (Commonwealth Department of Primary Industries and Energy (DPIE) & Commonwealth Department of Human Services and Health (DHS), 1994) uses population size and distance from the nearest service centre to determine seven discrete categories: (1) capital cities, (2) other metropolitan centres, (3) large rural centres, (4) small rural centres, (5) other rural areas, (6) remote centres and (7) other remote areas (Wakerman & Humphreys, 2008). ARIA (Australian Government Department of Health and Ageing, 2001) is presented as a continuous sliding scale of remoteness, divided into five classes: highly accessible (0-1.84), accessible (>1.84-3.51), moderately accessible (> 3.51-5.80), remote (>5.80-9.08) and very remote (>9.08-12) (Wakerman & Humphreys, 2008). Table 5-2 presents the RRMA and ARIA classification for each study site. Table 5-2 also details the Index of Relative Socio-Economic Disadvantage for each site (Australian Bureau of Statistics, 2008a). This index is derived from census variables like income, low educational attainment, unemployment, and dwellings without motor vehicles. Low values indicate areas of social and economic disadvantage and high values indicate areas of advantage.

Table 5-2: Demographic characteristics of the study sites

	HUB Tamworth	SPOKE Inverell	SPOKE Muswellbrook	SPOKE Quirindi	SPOKE Bingara	Australia
Population[^]	53,590	15,509	15,237	2,924	1,207	19,855,288
Age [^]						
≥ 65	8,346	2,763	1,545	660	407	2,644,378
% of pop ≥ 65	16%	18%	10%	23%	34%	13%
65-74	4,465	1,485	873	333	205	1,373,434
75-84	2,914	907	500	229	143	948,088
≥85	967	371	172	98	57	322,856
RRMA (SLA)	Large rural (3)	Other rural (5)	Small rural (4)	Other rural (5)	Other rural (5)	
ARIA (SLA)	Highly accessible (1.71)	Accessible (3.08)	Highly accessible (1.38)	Accessible (2.51)	Moderately accessible (4.33)	
Index of Relative Socio-economic Disadvantage [^]	963.66	949.16	945.42	980.74	953.57	
Study participants	N=49	N=32	N=15	N=35	N=16	
Distance from Tamworth (km)+		208	157	70	151	

Table legend

[^] Bingara (area), Inverell (area), Muswellbrook (area), Quirindi (area), Tamworth (city) (Australian Bureau of Statistics, 2008a)

⁺ (National Roads and Motorists Association, n.d.)

RRMA- Rural Remote and Metropolitan Areas

ARIA- Accessibility/Remoteness Index of Australia

SLA – statistical local area

5.5 Participants

One hundred and forty seven participants were randomised. Table 5-2 shows the number of participants located at each site. Participants were aged 65 years and over with the exception of three persons (aged 62, 63 and 64). These three persons had a history of cerebrovascular accident with residual mobility impairments, and were considered suitable for admission to the programme. There was no upper age limit, the oldest participant being 92 years of age. All participants were community-dwellers, living either independently within the community or in hostel accommodation.

5.5.1 *Inclusion/exclusion criteria*

To maximise generalisability, exclusion criteria were limited but there was an emphasis on safety and only persons thought capable of actively participating in the programme were invited to take part. The exclusion criteria were as follows:

1. Cognitive impairment: A moderate or severe intellectual impairment (as determined by an adjusted score of 5 errors or above on the Short Portable Mental Status Questionnaire). An exception was permissible for persons who scored 5-7 errors (moderate intellectual impairment) in circumstances where a carer agreed to assist the participant with their exercise programme. It was considered that persons with a degree of cognitive impairment may not adequately comprehend exercise instructions required to safely perform the home exercise programme.
2. Insufficient English language skill: In order to partake safely in the exercise programme participants were required to have an adequate level of English. Due to the rural location of the study sites, limited access was available to interpreter services. It was considered important that participants fully understood instructions to safely carry out their home exercise programme. Where persons had adequate English, they were not excluded on the basis of ethnicity.
3. Progressive neurological diseases: The study included a number of objective outcome measures. Physical parameters may be adversely affected by degenerative disease processes, independent of the effects of the intervention. Furthermore, in some neurological conditions, such as Parkinson's disease, functional variation may result from factors such as medication and concurrent medical conditions, independent to the effects of the intervention. These variations may impact upon outcome measures.

4. Medical conditions precluding exercise: The medical contraindications for exercise were obtained from the guidelines of the American College of Sports Medicine (American College of Sports Medicine, 1998) and the American Heart Association (Pollock et al., 2000). Absolute contraindications were recent acute myocardial infarction, critical or severe aortic stenosis, dissecting aortic aneurysm, uncompensated congestive cardiac failure, unstable angina, active or recent myocarditis, acute pulmonary embolus, ventricular tachycardia or other serious arrhythmias. Relative contraindications were aortic stenosis, uncontrolled supraventricular tachycardia, frequent ventricular ectopics, ventricular aneurysm or moderate uncontrolled hypertension.

5. Unable to walk ten metres: Participants were required to have a degree of independent mobility to participate in the exercise programme, and needed to be able to walk ten metres without rest or help (walking aid permitted).

5.5.2 Recruitment

Participants were recruited through either health care professionals (i.e. doctors, nurses, allied health professionals) (Appendix B.7, D.1 and D.3) or through public interest engendered via posters (Appendix B.1) and pamphlets (Appendix B.2) in public areas (doctors' surgeries, community health centres, hospitals, community centres), as well as articles in local newspapers (Appendix B.5 and B.6), and community announcements on local radio (Appendix B.3 and B.4) or the local television news programme. Health care professionals were provided with a letter explaining the programme (Appendix D.1 and D.3) and programme pamphlets. The study was supported by the North West Slopes (NSW) Division of General Practice (Appendix D.5). Each participant's doctor completed a medical clearance form (Appendix D.2.) during the pre-randomisation period. This was intended to exclude recruits not medically fit to undertake the exercise programme.

5.6 Implementation of the study

The method of implementation was the same at each site (Figure 5-3). Intervention participants undertook the baseline and post intervention (RCT) assessment and an interview. Control group participants undertook the baseline and post intervention (RCT) assessment. Both groups completed the monthly self-report calendars for one year. The physiotherapists who delivered the classes completed an exercise class attendance record for intervention participants. Physiotherapists and volunteer assistants were interviewed after the intervention. Figure 5-4

illustrates that the exercise phases, or order of implementation of the programmes across towns, were staggered over the course of 2006. The order was necessitated by practical considerations, primarily; geographic distance, human resource and time constraints.

Due to a lack of available resources in the study setting (e.g. limited available time on the part of physiotherapists) and potential difficulties accessing classes (e.g. geographical distance between participants' homes and class venues, and limited public transport options), the programme was presented as a once-weekly exercise class combined with a home exercise programme. Advantages of this format were that it offered regular supervision, social interaction, and a relatively high exercise dose, while requiring minimal physiotherapist delivery time and only one weekly trip for participants.

WEEK	INTERVENTION GROUP			CONTROL GROUP		PHYSIOTHERAPISTS	VOLUNTEERS
0	Baseline Assessment		Monthly calendar record	Baseline Assessment			
1	Weekly attendance record						
13							
14	Follow-up assessment	Evaluation interview		Follow-up assessment		Evaluation interview	Evaluation interview
52							
			Monthly calendar record		Monthly calendar record		

Figure 5-3: Phase structure

March 2006	Phase 1 Quirindi	Phase 2 Bingara	Phase 3 Tamworth						
April 2006				Phase 4 Inverell					
May 2006									
June 2006									
July 2006									
August 2006					Phase 5 Inverell	Phase 7 Quirindi	Phase 8 Muswellbrook		
September 2006								Phase 6 Tamworth	Phase 9 Tamworth
October 2006									
November 2006									
December 2006									
January 2007									
February 2007									
March 2007									
April 2007									
May 2007									
June 2007									
July 2007									
August 2007									

Pre assessment
Post assessment

Exercise programme
Calendar follow up

Figure 5-4: Schedule of phases

5.6.1 *Ethics*

Ethics approval was obtained from The University of Newcastle Human Research Ethics Committee (H-070-0705; Appendices A.2 and A.3) and The New England Area Health Research Ethics Committee (DB210; Appendix A.1). Prospective participants were fully informed of the research procedure and issued with Participant Information Statements (Appendix C.1). The statement clearly explained that the potential participant's relationship with the Area Health Service would not be adversely affected should they decide not to participate, and that they were free to withdraw from the study at any time. In order to be admitted to the study, participants were required to sign a Consent Form (Appendix C.2).

As stipulated in the ethics application, written approval was granted from various levels of management within the HNEAHS. These included the Chief Executive Officer of the HNEAHS (Appendix D.4), the Director of Operations Primary and Community Networks, the General Manager and Physiotherapist-in-Charge at Tamworth Rural Referral Hospital, and the Health Service Manager or Manager of the Community Health Centre at each study site.

5.6.2 *Staffing and researcher roles in the study*

The researcher undertook the majority of work for the study and was responsible for recruiting all participants to the study. However, it was necessary to recruit additional research staff due to the geographic distribution of the study sites, to ensure assessor blinding, to ensure safety of participants during physical assessments, and to collect and transcribe data from a sizeable number of participants. A research assistant, with a physiotherapy assistant background was specifically trained to conduct the RCT assessments. To promote consistency, the researcher undertook all the embedded study interviews. Due to the large volume of data gathered from the assessments and interviews, a second research assistant was specifically trained to enter some of the quantitative data and transcribe the interviews.

5.6.3 *Co-ordination of the project*

The project was co-ordinated by the researcher, who held undergraduate and postgraduate qualifications in physiotherapy and had some fifteen years of physiotherapy experience across a variety of settings. Local HNEAHS physiotherapists delivered the exercise programmes at their respective sites (six phases). The hub site (Tamworth) programmes were delivered by the researcher (three phases). In the capacity of co-ordinator, the researcher supplied the specifically-designed exercise programme (as a ready to use package), and provided training and support for its use. This involved:

- Provision of programme resources; the physiotherapist manual (Appendix E.1), participant manual (Appendix E.2), and a set of additional resources (Appendix E.1)
- An individual on-site training session with each physiotherapist and assistance to set up their exercise equipment/circuit stations
- Additional physiotherapist training and support by convening a teleconference and face-to-face meeting
- The researcher maintaining periodic contact (by phone and email) with the physiotherapists throughout the duration of their programmes and being available to respond to queries upon request.

5.6.4 *The volunteer assistants*

The volunteer assistants were recruited by the health service volunteer co-ordinator at each of the HNEAHS hospitals. Volunteers were required to meet pre-determined criteria (e.g. they had to be physically able themselves) (Appendix D.8). The researcher initially spoke with interested persons, explained the role and requirements and answered any questions. Interested persons were provided with an Information Statement (Appendix C.3) and Consent Form (Appendix C.4). Prospective participants were requested to return their completed Consent Form to the researcher, should they wish to proceed.

The researcher provided volunteer assistants with training, which outlined the programme and role of volunteer assistants (Appendix D.9). From this point, volunteer assistants worked with their local HNEAHS physiotherapist. In addition, they were provided with the researcher's contact details and encouraged to contact her if questions or concerns arose.

5.6.5 *Storage, access and disposal of data*

Data were coded and stored separate from personal details. The data were de-identified for analysis purposes. Identifying hardcopy material and computer discs were kept in a locked filing cabinet at the University Department of Rural Health, Tamworth. Identifying electronic information was stored on a computer and password protected. Access to the hardcopy and electronic information was limited to the research team conducting the study.

5.6.6 *The researcher's background and position*

Within the context of qualitative research it is important to consider the background and potential influence of the researcher (Richards, 2005). In the present study, the researcher was a physiotherapist of some fifteen years experience. The majority of this employment has taken place in rural areas, including nine years with the HNEAHS. Therefore, my perspective was not that of a detached independent investigator but rather an interested insider. My physiotherapy experience had the potential to have both positive and negative influences on the study. On the one hand, I had the background to understand the issues that arose during the course of the research. On the other hand, participants were informed that I was a physiotherapist employed by HNEAHS and I knew some participants prior to undertaking the study. During the interviews participants may have doubted my impartiality and perhaps been reluctant to express their true feelings or experiences. Further, as a consequence of my background, I may have brought to the study some preconceptions that could have unconsciously influenced the way I approached the interviews, analysis and interpretation.

The point of this declaration is to assure the reader that I was aware of my insider status, especially in the qualitative part of the research, as were my supervisors who monitored the objectivity of the research process. Throughout, I paid close attention to my actions and role in the study. As part of the reflexive process, I regularly questioned myself with regard to my understanding and the origins of my perspective. At the stage of interviews, I was conscious of the need to gain the trust of the informants, state my position and adhere to the approved ethical requirements.

5.7 Summary

The present study used an embedded experimental model to explore various facets of the rural exercise intervention. Specifically, the quantitative experimental methodology (RCT) evaluated programme outcomes, while the embedded qualitative component evaluated processes and extended understanding of the outcomes. This chapter overviewed the research design and implementation, focussing on elements common to both the RCT and embedded study. The ensuing chapters will present details of the methodology specific for the RCT (Chapter 6) and the embedded study (Chapter 7).

CHAPTER 6: METHODS OF THE RANDOMISED CONTROLLED TRIAL

6.1 Introduction

Chapter 5 presented the methodological rationale of the overall study. It provided an overview of the study's design and described those elements common to both the RCT and embedded study. This chapter describes the methods used to conduct the RCT. Specifically, it discusses the RCT design and presents the intervention. The latter part of the chapter focuses on the data collection strategies and analysis of the RCT.

6.2 The Randomised Controlled Trial design

To depict the RCT reference is made to Campbell and Stanley's (1963) widely adopted notation system. Figure 6-1 shows Campbell and Stanley's (1963) true experimental design where X is used for the independent variable, O for the dependent variable, and R for random sample selection.

However, as pointed out by DePoy and Gitlin (2005), it is often difficult or inappropriate for health professionals to select a sample from a larger pre-defined population based on random selection (R). Rather, in health research participants typically enter studies on a volunteer basis. From this sample of convenience, participants are randomly assigned to either the experimental or control group. This situation is portrayed in DePoy and Gitlin's (2005) modified version of Campbell and Stanley's (1963) true experimental design (Figure 6-2). The substitution of r for R denotes this important structural distinction.

The present RCT was based on the DePoy and Gitlin (2005) design. Specifically, we used a two group design in which participants were randomly assigned to either the experimental condition (intervention) or control condition. Prior to the intervention, all participants were tested on the dependent measures (O). For the intervention group the independent variable (exercise programme) was offered (X), and it was withheld from the control group. After the intervention, all participants were tested again on the dependent variable (O).

R	O	X	O
R	O		O

Figure 6-1: Campbell and Stanley's true experimental design

r	O	X	O
r	O		O

Figure 6-2: Depoy and Gitlin's version of the experimental design

For the present RCT, the researcher selected volunteer participants who met the inclusion/exclusion criteria. Individuals were wait-listed and admitted to the study in the order of their registration, by site.

6.2.1 Sample size calculations

Sample size calculations were conducted prior to commencing the study using t-test sample size software. They revealed that a sample size of 79 per group would be required to detect improvements in Physiological Profile Assessment (PPA) scores (primary outcome measure) of 0.55 in the intervention group and 0.1 in the control group (80% power and type 1 error (alpha) of 0.05). Assuming a dropout rate of 17.5%, 96 participants would need to be recruited in each group. In the time allocated for the study, we were able to recruit 150 participants not 192.

This trial was not powered to detect a change in the between-group incidence of falls over a one-year period. If the percentage of people in the control group falling at least once during the follow-up year was 40% and the intervention group proportion was 25%, a sample size of 200 in each group would provide a power of 0.80 to detect this difference (type 1 error = 0.05, drop out date of 17.5%). However, an analysis was conducted on the incidence of falls to determine if there was a trend towards improvement.

6.2.2 Randomisation

One hundred and fifty persons were initially recruited to the study. Due to a change in their personal circumstances, three recruits dropped out prior to randomisation. One hundred and forty seven persons were randomised to the intervention (n=74) or control (n=73) groups. Randomisation was staggered (but not stratified) to coincide with commencement of the exercise programmes at the various sites.

Randomisation took place after participants had completed the Consent Form and undertaken the baseline assessment. Allocation to groups was undertaken by an off-site research

physiotherapist who was not involved in participant recruitment. Randomisation was by computer generated random numbers. The sequence was generated using the random number function in Excel (Excel 2003, Microsoft Corporation, SEA, Washington State, USA) with blocks of undisclosed size. These details were also provided to an on-site research assistant (not the assessor). The assistant sent letters to all participants (Appendices G.3 and G.4) advising of their group allocation and provided details of follow-up arrangements. The assistant also sent letters to doctors who had completed medical clearance forms, to advise of their patient's group allocation (Appendices G.1 and G.2).

The researcher delivered the exercise programmes at the hub site (the assistant, blinded to group assignment, undertook follow-up assessments at the hub site). The research assistant and researcher, blinded to group assignment, undertook all initial assessments (hub and spoke sites) and follow-up assessments at the spoke sites.

6.3 The intervention

The aim of the exercises was to challenge balance within a safe and structured environment, thereby enhancing functional ability. To achieve this, exercises mimicked the requirements of daily tasks and required controlled movements of the body in weight-bearing positions with an emphasis on reducing arm support. The exercises were individually tailored and progressed.

6.3.1 Exercise prescription

Ten exercises formed the basis of both the circuit class and home exercise programme. A basic version of each exercise is presented in section 6.3.5 of this chapter. Physiotherapists were requested to consult each participant's summarised medical history (provided by the researcher). They were instructed to start by assessing a participant's performance on the basic version of each exercise.

Several variations were applicable to each basic exercise (Appendices E.1 and E.2). As part of the assessment/prescription process, physiotherapists used variations to tailor the exercise for an individual's ability. Over time variations were used to progress (or regress if necessary) the exercises. Variations were not mutually exclusive and could be combined to suit participant needs.

6.3.2 *The exercise class*

Each exercise class consisted of three parts: a warm-up (five minutes), an exercise circuit (stimulus phase 30-40 minutes) and a cool-down (five minutes). The warm-up prepared the participant's body for exercise and the cool down assisted return to a state of relative rest (Brukner & Khan, 2007; Pollock et al., 1998). The warm-up and cool-down comprised stretching exercises for the upper and lower body (e.g. gastrocnemius) and integrated body movements (e.g. slow walking, marching). To promote participant interest and motivation, the content of the warm-up and cool-down was varied from week to week. Physiotherapists chose warm-up and cool-down exercises from the options presented in the physiotherapist's manual (Appendix E.1). The circuit consisted of ten stations (one for each basic exercise).

The length and content of the classes increased over the 13 week programme. Initially each circuit station was two minutes in duration. During week six of the programme, the circuit stations were increased to three minutes duration. Additional time was allowed for participants to transit between stations. Participants were instructed to rest as required during and between circuit stations. A rest and drinks break was scheduled half way through each circuit.

Physiotherapists were provided a physiotherapist's manual to assist them in delivering the exercise classes (Appendix E.1). This manual contained an introduction to and overview of the programme, the participant's manual, a description of the warm-up and cool-down exercises, and details of the ten basic exercises and their variations. The latter part of the manual contained additional programme resources; circuit station signs, exercise class record sheets, home exercise programme record sheet, home programme review plan and exercise class attendance sheet.

Physiotherapists used the exercise class record sheet to maintain a record of each participant's exercises, related variations, repetitions of each exercise amount and special instructions. The sheets were laminated and adjustments to exercise programming were recorded over the course of the programme. Participants took their exercise sheet from station to station, so details of their programme were readily accessible to them, the physiotherapist and volunteer assistant.

6.3.3 *The home exercise programme*

Intervention participants were asked to perform their home exercise programme on three occasions per week for one calendar year. The home exercise programme was chosen from the ten basic exercises, with variations selected to optimise safety in the home. The aim was to

develop and progress the home exercise programme over the 13 week period of exercise classes. Initially participants were prescribed three to four home exercises.

Participants attended an introductory session, the week prior to commencing the exercise classes. At this session the physiotherapist provided an overview of the exercise programme (classes and home programme) and gave participants their home programme manual (Appendix E.3). The manual contained a general introduction to the programme, advice about safe exercise, a guide to additional information and a set of loose leaf plastic sleeves. The physiotherapist explained the content of the manual, clarified the purpose and structure of the home programme, and answered any questions. At this introductory session, the physiotherapist individually prescribed a selection of exercises for each participant.

The programme package provided to physiotherapists included one set of ten home exercises sheets per participant (Appendix E.3). Each sheet presented an exercise including diagram, instructions, and a blank space for the physiotherapist to write the details of variations, number of repetitions and special instructions. The physiotherapist selected sheets for the exercises they wished to prescribe, and wrote the details of any variations, number of repetitions and special instructions. These sheets were placed in the plastic sleeves at the rear of the participant's manual.

The home exercise programme was reviewed on a regular basis. The class was divided into two sub-groups to assist in individualising the reviews and progressions. Home programme reviews for each sub-group took place on alternate weeks, immediately following the class. As new exercises were prescribed, instruction sheets were prepared and added to the participant's manual. Any amendments (e.g. progressions) to previously prescribed exercises were noted on the exercise sheets in the participant's manual.

Physiotherapists used a home exercise programme record sheet (Appendix E.1) to note the details of the exercises prescribed, variations, number of repetitions and special instructions. These sheets were laminated, permitting modification of the home programme from one review session to the next.

6.3.4 *Equipment*

The requirements for exercise equipment were kept to a minimum for both the class and home programme. Wherever possible the exercise programme made use of equipment commonly available in hospital physiotherapy departments or people's homes. However, there were a few

items of equipment considered important to the RCT but not available at participating physiotherapy departments. These items added to the versatility of the programme by increasing the range of available variations. Therefore each site was provided with two small blocks (5cm), two medium blocks (12cm), one tall block (20cm), one Airex © balance pad (Gaugler & Lutz, Germany) and one exercise floor mat.

6.3.5 The basic exercises

The following section presents the ten basic exercises used for both the class circuit and home programme. The reader is referred to Appendices E.1 and E.2 for details of possible variations to each exercise. A support (chair, rail etc.) was provided for each exercise. Where a participant could safely perform an exercise without use of a support, they were encouraged not to use the support. However, the support was kept in place at all times, so it was available for use if the need arose. Diagrams relating to the exercises were obtained from the physiotherapyexercises.com website which provides physiotherapy exercises for people with spinal cord injuries and other neurological conditions. The exercises chosen were designed to address balance. Similar exercises have been found to improve mobility and reduce risk in older people who have been in hospital (Vogler, Sherrington, Ogle, & Lord, 2009) and in outpatient rehabilitation (Sherrington, Pamphlett et al., 2008).

Stepping forwards onto a block

The participant was positioned in standing with a block in front of them. The participant stepped up onto the block (Figure 6-3) and descended to the start position.



Figure 6-3: Stepping forwards onto a block

Stepping sideways onto a block

The participant stood next to a block. They stepped up onto the block, leading with the foot nearest the block and following with the more distant foot (Figure 6-4). The participant then descended sideways to the start position, by reversing their foot order.

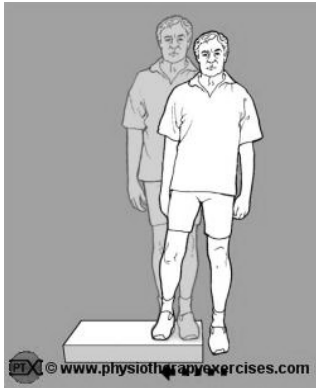


Figure 6-4: Stepping sideways onto a block

Stepping forward

A flat marker or, as a progression, a polystyrene cup was placed on the floor in front of the participant. The participant kept one foot firmly on the floor. The other foot was stepped forward to lightly tap over the cup (Figure 6-5) and then returned to the starting position. The aim was to avoid losing balance and crushing the cup.



Figure 6-5: Stepping forward

Stepping in different directions

The participant was positioned standing with floor markers around them. They kept one foot firmly on the floor. The other foot was stepped to lightly tap over a floor marker and returned to the starting position (Figure 6-6). This sequence was repeated with step-taps to the various markers.

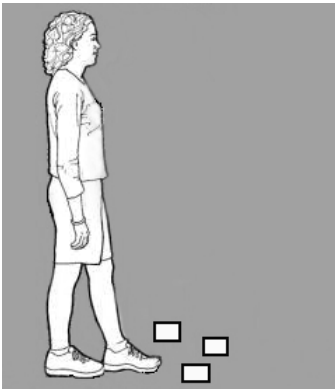


Figure 6-6: Stepping in different directions

Semi-tandem and tandem stance

The participant stood in semi-tandem or tandem position. The semi-tandem position involved placing the heel of one foot next to the great toe of the other foot with both feet flat on the floor (i.e. a narrower base than normal stance [Figure 6-7a]). The tandem position involved placing the heel of one foot directly in front of the toe of the other foot, with both feet flat on the floor. A variation of ‘tandem stance’ involved participants walking heel-toe forward along a straight line (Figure 6-7b and c).

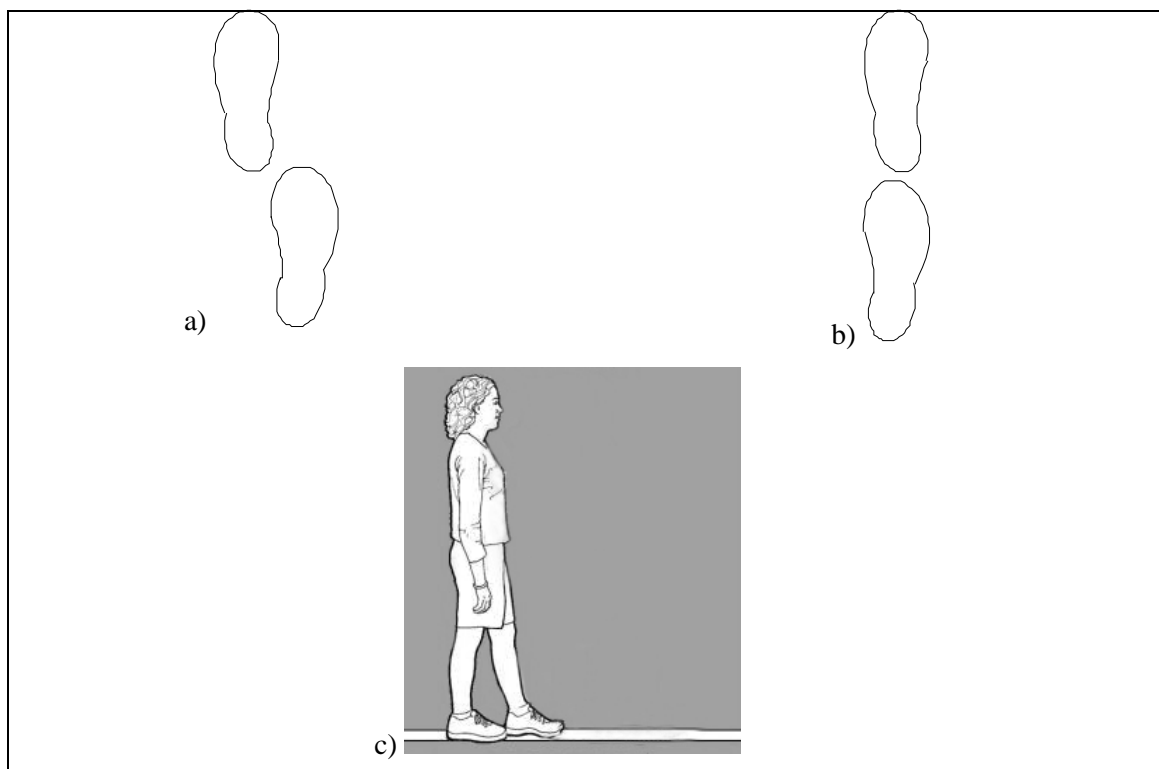


Figure 6-7: a) Semi-tandem stance, b) tandem stance, and c) tandem standing on a line

Walking tasks

The aim was to practise walking in a manner that was most challenging for the participant whilst remaining safe. Options included walking with a walking aid, walking unaided in a straight line, tandem walking (Figure 6-8), walking on toes, multitasking (e.g. walking while holding a ping pong ball in a spoon or walking while carrying a laundry basket), walking a figure of eight and obstacle courses (Figure 6-9).

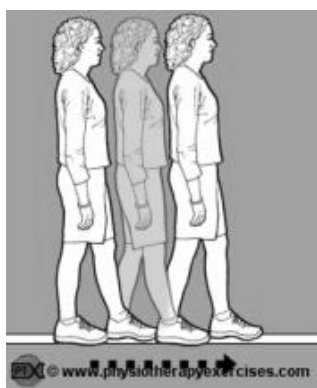


Figure 6-8: Tandem walking

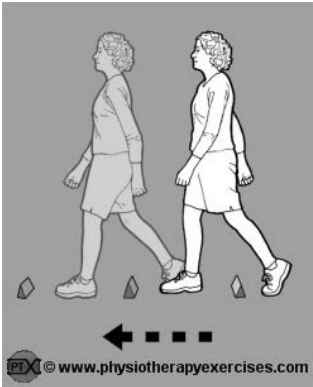


Figure 6-9: Walking over obstacles

Sit-to-stand

This exercise began in a sitting position, initially on the highest chair available. The participant's feet were positioned underneath their knees. They practiced standing up and sitting down again (Figure 6-10). Initially the participant stood up from the chair using their arms for assistance. Where able and safe to do so, they were to progress to standing without use of their hands.

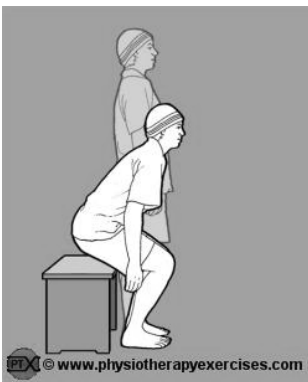


Figure 6-10: Sitting to standing

Knee bends

The participant stood behind a chair with their feet placed at shoulder distance apart. The participant slowly squatted down by bending their knees and taking care to keep their knees positioned over the toes. They descended to the point just before they needed to raise their heels from the ground (Figure 6-11). They then ascended slowly back to the start position.

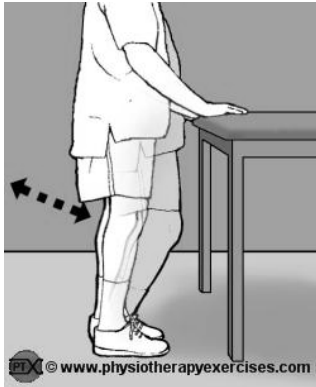


Figure 6-11: Knee bends

Heel raises

The participant stood with feet shoulder width apart, next to a secure bench or chair. They lifted their heels from the ground slowly to a point of comfort and where they could still maintain balance. The raised position was maintained for one second. The participant then returned their heels to the floor (Figure 6-12).



Figure 6-12: Heel raises

Reaching

The participant stood with their feet slightly apart in front of a table or bench (preferably with overhead cupboards) at hip level. An object was positioned a little further than an arm's-length away. The participant reached to touch/retrieve the object, while their feet remained firmly on the floor (Figure 6-13).

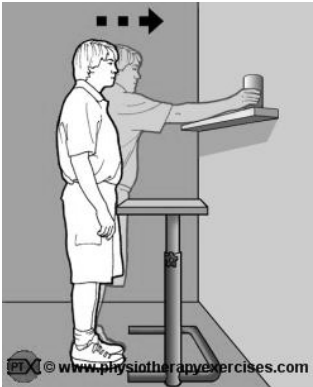


Figure 6-13: Reaching

6.3.6 *Social aspects of the program*

To facilitate enjoyment of the classes and ongoing participation in the research morning/afternoon tea was provided and participants were encouraged to socialise. This also provided an opportunity for the physiotherapist to engage in the home program reviews of the exercise sub-group. The volunteers assisted with morning/afternoon tea and facilitated group interaction.

6.3.7 *The fall prevention booklet*

All participants were given an information booklet entitled ‘Don’t fall for it. Falls can be prevented! A guide to preventing falls for older people’ (Appendices D.6 and D.7) (Australian Government Department of Health and Ageing, 2004). It contained information on a range of strategies to prevent a fall but did not focus specifically on exercise. The booklet was offered in an attempt to encourage ongoing participation in the research and provide general information. Aside from the booklet, control group participants received usual care.

6.3.8 *Background information*

At the baseline assessment, a wide range of background information was collected (in order to describe the study population). This included demographic characteristics, fall history over the previous year, co-morbidities and medication intake. Participants also undertook the Short Portable Mental Status Questionnaire, a ten item questionnaire to detect the presence and degree of organic brain deficit in the elderly (SPMSQ)(Pfeiffer, 1975) (Appendix F.1).

6.3.9 *Measures of adherence to the intervention*

Exercise diaries

Participants in both the intervention and control groups were asked to maintain an exercise diary. These diaries took the form of 12 monthly calendars, provided to participants at the baseline assessment. Recording took place over a one year period, from the time of the baseline assessment. Each month the participants would return their completed calendars to the researcher (by prepaid envelope). In the instance that a calendar was not returned, the researcher telephoned the participant, sought the relevant information and completed the calendar.

The calendars were similar for both groups (Appendices F.2 and F.3). Intervention participants were asked to record on their calendar 'HP' for each occasion of the home exercise programme and 'E' whenever they did general exercise (≥ 15 minutes duration). Control group participants were requested to record on their calendar 'E' whenever they did general exercise (≥ 15 minutes duration). 'E' was recorded to gain an understanding of the mean weekly occasions of general exercise both the intervention and control groups undertook.

Attendance records

Each physiotherapist was supplied with an attendance record sheet (Appendix E.1) and requested to record their participants' weekly attendance/absence. The completed attendance sheets, for the spoke sites, were collected after the post intervention assessments.

6.4 Outcome measures

The RCT comprised a number of physical tests from various sources to investigate fall risk factors. The assessors were blinded to group allocation. Training sessions and a written measurement protocol were used to maximise inter-tester reliability. Safety was ensured for all balance measures by testing next to a sturdy support, such as a plinth or parallel bars, which the participant could hold if required. The assessor also stood nearby to give additional support as required. A second assessor was available to assist. All times were recorded using a stopwatch and measurements made with a tape measure.

6.4.1 *Primary outcome measures*

The Composite Physiological Profile Assessment falls risk score

The PPA is a quantitative falls risk assessment tool developed by Lord et al. (Lord, Menz, & Tiedemann, 2003). It provides valid and reliable measures which may be used to evaluate falls risk and the effectiveness of interventions (Anstey, Smith, & Lord, 1997; Liu-Ambrose, Khan, Eng, Janssen et al., 2004; Lord & Castell, 1994; Lord, Menz et al., 2003; Lord et al., 2005). In particular the PPA has been demonstrated to be highly predictive of the risk of falling. Lord, Clark and Webster (1991) undertook a one year prospective study of 95 residents, aged 59 to 97 years, living in an intermediate care hostel. In their study, the PPA measurements were able to correctly classify participants into a multiple fallers group (two or more falls) or a non-multiple fallers group (zero or one fall) with an accuracy of 79%. In a second one year prospective study, this time involving 414 community-dwelling women aged 65 to 99 years, the PPA measurements were able to correctly classify subjects into a multiple fallers group or a non-multiple fallers group with an accuracy of 75% (Lord, Ward, Williams, & Anstey, 1994). Lord et al. (2003) reported test-retest reliability for the individual PPA measures (intra-class correlation coefficients [95% CI]) as; contrast sensitivity 0.81 (0.70-0.88), proprioception 0.50 (0.15-0.74), knee extension strength 0.97 (0.93-0.98), hand reaction time 0.69 (0.45-0.84), and standing sway 0.68 (0.45-0.82). Categories described by Fleiss (1986) may be used to assist in interpretation of the intra-class correlation coefficient (ICC) values; >0.75 excellent reliability, 0.40-0.75 fair to good reliability and < 0.40 poor reliability.

Using the PPA it is possible to evaluate five individual risk factors; knee extension strength, standing sway, finger press reaction time, edge contrast sensitivity and proprioception. The composite PPA score is calculated from the weighted physical performance of the five domains. A score below 0 indicates a low falls risk, a score between 0 and 1 indicates a mild risk, between 1 and 2 indicates a moderate risk and above 2 represents a high falls risk (Figure 6-14) (Lord, Menz et al., 2003). A detailed explanation of the five individual tests of the PPA is provided in section 6.4.2 of this chapter.

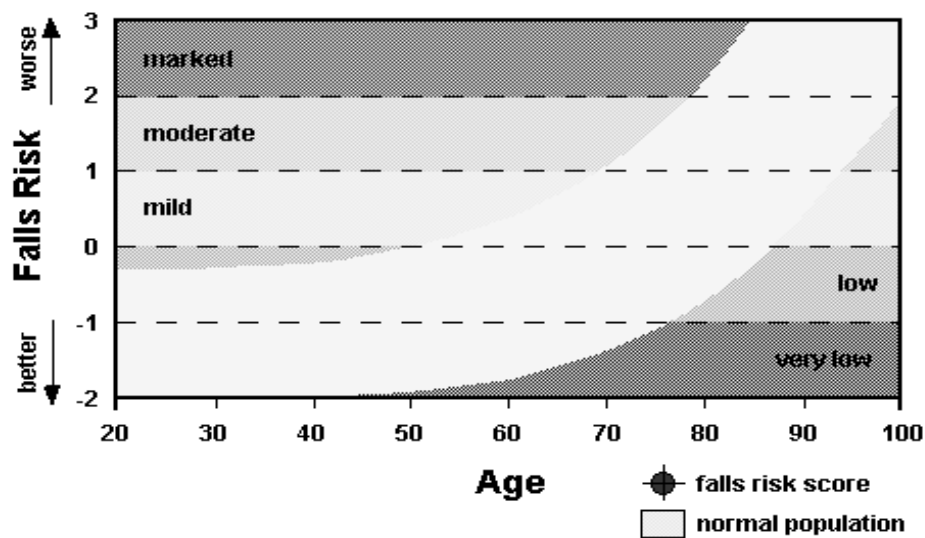


Figure 6-14: Falls risk score by age (Lord, Menz et al., 2003)

Berg Balance Scale

The Berg Balance Scale (BBS) is the best known clinical balance tool (Tyson & Connell, 2009). The scale was developed to assess balance in older adults (Berg, Wood-Dauphinee, & Williams, 1995; Wood-Dauphinee, Berg, Bravo, & Williams, 1997). Since this time its usability has also been tested and established in a range of populations including; community-dwelling elders, stroke rehabilitation, Parkinson's disease, multiple sclerosis, spinal cord injury and vestibular dysfunction (Blum & Korner-Bitensky, 2008; Lemay & Nadeau, 2010; Qutubuddin et al., 2005; Tyson & Connell, 2009; Whitney, Wrisley, & Furman, 2003; Wrisley & Kumar, 2010). When used as a predictive scale, the BBS has also been found to be predictive of multiple falls (Muir, Berg, Chesworth, & Speechley, 2008).

The scale comprises 14 tasks quantified on a five point scale. Tasks assess ability to maintain balance, either statically or while performing various functional movements (Berg, Wood-Dauphinee, Williams, & Gayton, 1989). These tasks are common to everyday life and not included in the PPA. Scores of the individual tasks are added to determine the total score, which ranges from 0 to 56. A higher score reflects better balance (Berg et al., 1989).

Berg et al (1989) found high inter-rater and intra-rater reliabilities (inter-rater and intra-rater reliability ICCs = 0.98 and 0.99, respectively) and high internal consistency (Cronbach's alpha = 0.96). Two recent systematic reviews examined the psychometric properties of the BBS. Blum and Korner-Bitensky (2008) looked at use of the BBS specific to stroke. Tyson and

Connell (2009) examined use of the BBS in adults with neurological conditions. These reviews found the BBS had strong reliability, validity and responsiveness to change.

6.4.2 Secondary outcome measures

Functioning is complex in older people (World Health Organisation). For this reason we chose to use a number of tests to measure the effects of this exercise programme on different aspects of health and physical function.

PPA tests to evaluate individual risk factors

The five individual risk factors from the PPA were included as secondary outcome measures in an attempt to explain any changes in the primary outcome measure of composite PPA falls risk score. These tests have been shown to be valid and reliable for assessing falls risk and the effects of interventions aimed at reducing risk of falling (Lord, Menz et al., 2003). For the purposes of the RCT, each of the five tests was administered in accordance with the standard test instructions detailed in the 'FallScreen© Physiological Profile Assessment Short Form Test Instructions' manual, published in 2003, by the Falls and Balance Research Group of Neuroscience Research Australia. The diagrams and test descriptions presented below, were obtained from the manual and the Neuroscience Research Australia website (Neuroscience Research Australia).

Knee extension strength

A spring balance was attached to the posterior bar of the PPA standard test kit stool and then strapped around the participant's ankle, 5cm above the medial malleolus (Lord, Menz et al., 2003). Padding was inserted under the strap to protect the skin. The assessor ensured the participant's hip and knee angles were at 90 degrees. The participant was instructed to hold the side of the stool for support and extend the leg against the strap as strongly as possible. With reference to the spring balance reading, the best of three trials was recorded (in kilograms). Readings were taken for both the right and left leg, unless precluded by injury or pain. Figure 6-15 illustrates the test set-up.



Figure 6-15: Knee extension strength testing

Reaction time – hand

The reaction timer comprised a modified computer mouse button depressed by the participant's finger in response to a randomly flashing light. The light source was located adjacent to the response switch. The source was bright (i.e. suprathreshold) to ensure the test was not overtly influenced by the participant's level of visual acuity. The participant was instructed to press the button as soon as they saw the light come on. The response time was measured in milliseconds. Figure 6-16 illustrates the test set-up.

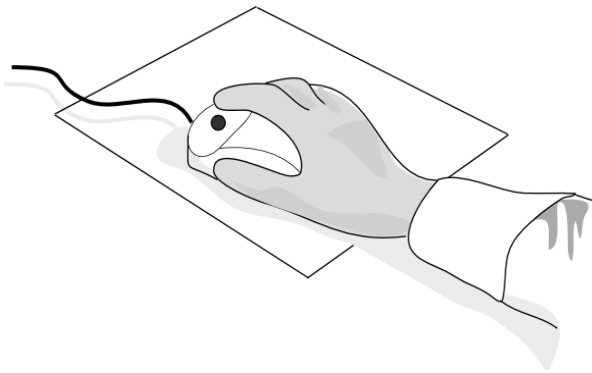


Figure 6-16: Finger press reaction time testing

Contrast sensitivity

Edge contrast sensitivity was assessed using the Melbourne Edge Test (Verbaken & Johnston, 1986). This test presents 20 circular patches of 25mm diameter containing edges with reducing contrast and variable orientation as the identifying features. A four alternative forced choice method of presentation was used. That is, the edges were presented in the orientations of; horizontal, vertical, 45 degrees left and 45 degrees right. A key card presenting the four possible angles was used for participant instruction. The lowest contrast patch correctly identified was

recorded as the participant's contrast sensitivity in dB = $-10\log_{10}$ contrast. Figure 6-17 shows the Melbourne Edge Test. Whilst it could not be expected that this result would change after exercise it is one domain of the PPA, and was therefore included as an outcome measure for use in PPA composite score calculations.

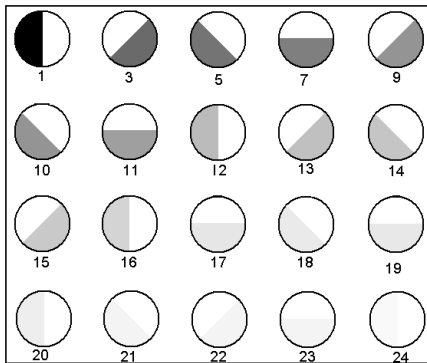


Figure 6-17: Contrast sensitivity testing

Proprioception

The participant sat in a standard chair with a Perspex plate (60 x 60 x 1cm thick) placed vertically between their feet. A protractor was inscribed on the plate, with lines at two degrees apart. Proprioception was measured by asking the participant, with eyes closed to align their lower limbs on either side of the plate. Any difference in matching the great toes was recorded, to an accuracy of one degree. The test was administered as quickly as practical to minimise the effects of lower limb weakness. Figure 6-18 illustrates the test set-up.

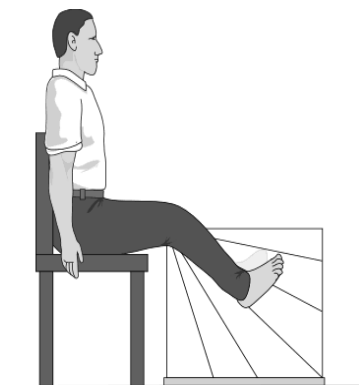


Figure 6-18: Test for proprioception

Standing balance (standing sway)

A swaymeter measured sway as displacements of the body at waist level. The swaymeter comprised a 40cm long rod with a vertically positioned pen at its end. The rod extended behind the participant and was attached to their waist by a firm belt. Participants were asked to stand as still as possible for 30 seconds while the pen recorded their body perturbations on a sheet of millimetre graph paper fastened to the top of an adjustable height table. Figure 6-19 illustrates the test set-up. Figure 6-20 shows example traces.

Each participant was requested to perform the test under four conditions. These conditions altered the sensory input participants received while performing the task. The conditions were; 1) eyes open and feet on the floor, 2) eyes closed and feet on the floor, 3) eyes open and feet on a foam mat, and 4) eyes closed and feet on a foam mat. Closing the eyes removed the visual input and required the participant to rely primarily on their peripheral sensation to perform the test. Standing on the mat reduced proprioception and peripheral input. The mat was constructed of medium density foam rubber, 60 x 60 cm and 15cm thick. Total sway (number of millimetre squares traversed by the pen) in the 30 second periods was recorded for each of the four conditions.

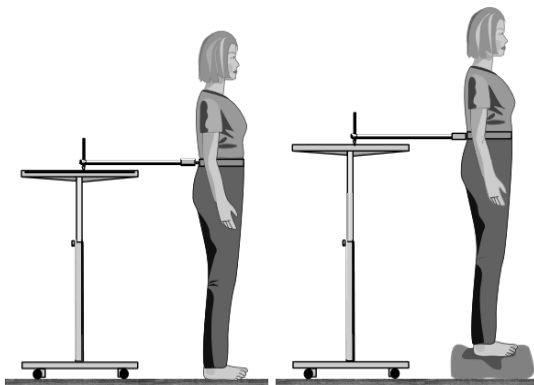


Figure 6-19: Tests of standing balance

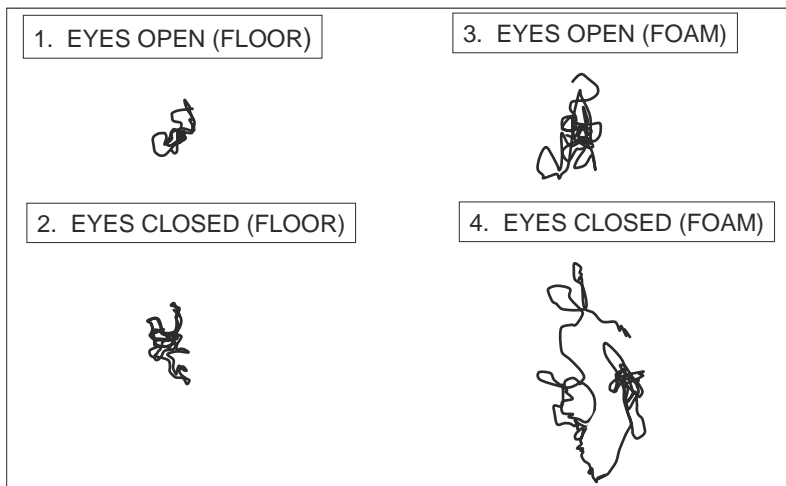


Figure 6-20: Example sway traces. Anticlockwise from top left: 1. eyes open stand on floor, 2. eyes closed stand on floor, 3. eyes open stand on foam, 4. eyes closed stand on foam

Berg Balance Scale component tests

Four of the 14 items in the Berg Balance scale were timed or measured, in an attempt to understand any differences in the Berg Balance Scale total score. A description of these items is presented below.

Standing on one leg

Time the participant was able to stand on one leg without holding on to a support (to a maximum of ten seconds).

Reaching in standing

The participant's straight arm was positioned at 90 degrees of shoulder flexion. The assessor placed a ruler at the participant's middle fingertip. The recorded measure was the distance forward that the fingertip reached (when the participant was at their maximum lean forward position). Wherever possible, participants were requested to use both arms to avoid rotation of the trunk.

Turn 360 degrees

Time taken to turn around in a full circle.

Placing alternate foot on step

The participant stood unsupported and placed each foot alternately onto a step. A record was taken of the total number of foot placements over a 20 second period.

Other tests of balance and mobility

Maximal balance range and coordinated stability

Maximal balance range and coordinated stability are representative of functional balance and complement the sway test used in the PPA (Lord, Ward, & Williams, 1996). In previous studies both measures have been found useful at detecting between-group differences in community based exercise trials (Lord, Castell et al., 2003; Vogler et al., 2009).

Maximal balance range was measured with the rod of the swaymeter extending in front of the participant. A pen attached to the end of the rod recorded the anterior-posterior movements of the participant on a piece of graph paper, fastened to the top of an adjustable table. The participant was asked to lean forward and then backward as far as possible, that is to the point where they could just maintain balance. Instructions were to move from the ankles without moving the feet. The participant had three attempts at the test. The attempt with the maximal anterior-posterior distance was taken as the result and recorded in millimetres.

Figure 6-21 illustrates the test and Figure 6-22 displays an example trace.

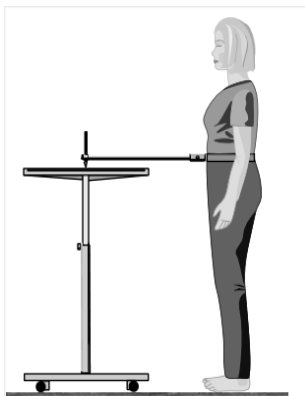


Figure 6-21: Maximal balance range testing

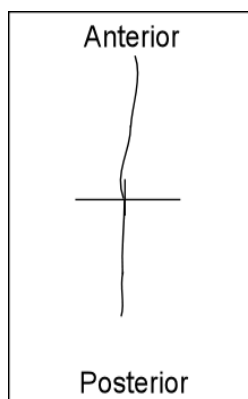


Figure 6-22: Example trace

The coordinated stability task measured a participant's ability to adjust balance in a steady and coordinated way whilst placing them at or near the limits of their equilibrium. A standard convoluted track was printed on a piece of paper. The sheet of paper was fixed to an adjustable height table. The rod of the swaymeter extended anteriorly, with the vertically positioned pen placed at the start position marked on the track. The participant was asked to adjust balance by bending or rotating their body without moving their feet (i.e. move the centre of gravity), so the pen at the end of the rod followed and remained within the 1.5cm track.

Error scores were accrued whenever the participant was unable to adjust their centre of gravity sufficiently, causing the pen to deviate outside the track margins. Deviations were assigned a score according to their location. Because the outside corners challenged balance to a greater extent, errors on an outside corner accrued 5 error points, errors elsewhere accrued one error point. A total error score was calculated using the formula: total error score = (number of corner errors x 5) + (number of other errors). To complete the test without errors, a participant had to be capable of adjusting the position of the pen 29cm laterally and 18cm in the anterior-posterior plane. Figure 6-23 shows the test set-up. Figure 6-24 displays an example trace.

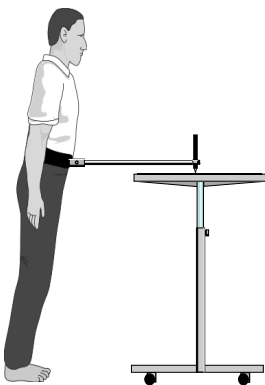


Figure 6-23: Coordinated stability test

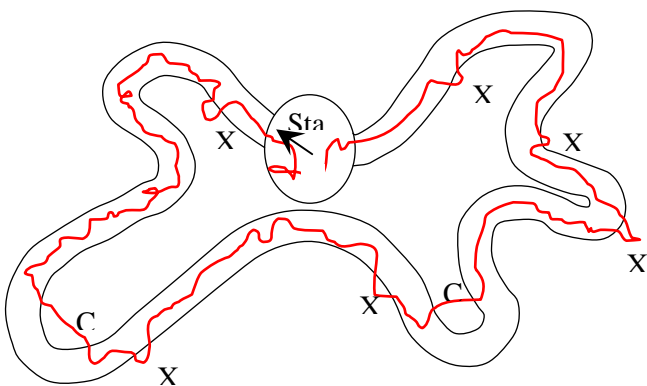


Figure 6-24: Example trace

Choice Stepping Reaction Time (CSRT)

The test of choice stepping reaction time requires steps from either leg, and transfers of body weight and balance. These are similar to the requirements for step responses to avoid a fall (Lord & Fitzpatrick, 2001). The CSRT test described by Lord and Fitzpatrick (2001) has been demonstrated to be predictive of falls. However, this test requires specialised equipment, which is a platform with built in illuminating panels. As this RCT used five widely distributed geographic sites, a portable version of the electronic CSRT was used.

Participants stood on a non-slip black mat (1.24m x 0.94m.). The mat contained six painted rectangular panels (28cm x 13cm), as shown in Figure 6-25. The panels (footplates) marked in bold indicate the participant's stance position. Each of the four panels in front of the footplates was assigned a label (front right, side right, front left, side left). Participants were asked to step into whichever panel the instructor specified, as quickly as possible, using the left foot for the left two panels (front and side) and the right foot for the right two panels. The test commenced with ten practice trials involving the four possible positions. This was followed by the ten actual trials, for which the assessor read foot positions from a standardised script. The time period required to complete the ten actual trials was measured in seconds.

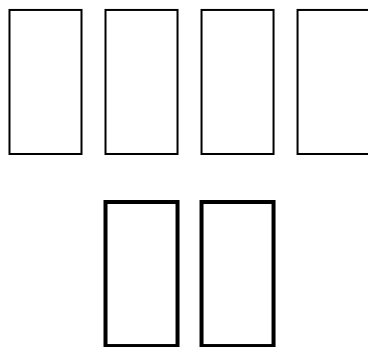


Figure 6-25: Placement of panels on the portable CSRT mat

Ten metre walk test

Slow gait speed is associated with an increased risk of falls (Bootsma-van der Weil et al., 2002; Imms & Edholm, 1981). Measures of gait speed are included in fall risk assessment scales (Piotrowski & Cole, 1994; Podsiadlo & Richardson, 1991) and have been used as an outcome measure in a number of studies with elderly populations (Guralnick et al., 2000; Guralnik, Ferrucci, Simonsick, Salive, & Wallace, 1995; Sherrington & Lord, 2005; Sherrington, Pamphlett et al., 2008; Vogler et al., 2009). The ten metre walk test is a component of the Short Physical Performance Battery (Guralnik et al., 1994). A recent study by Tiedemann, Shimada,

Sherrington, Murray and Lord (2008) found a similar test, the six meter walk test, to be predictive of falls.

A ten metre straight line was measured and marked in a hospital corridor. Participants were asked to walk this distance with their usual walking aid and at their normal walking speed. Two metres were allowed at the approach and finish of the ten meter distance, to encourage a constant walking speed across the ten metres. An assessor recorded the time in seconds to walk ten meters, number of steps taken and type of walking aid used.

Sit to stand test

The sit to stand test is used to measure lower limb strength (Csuka & McCarty, 1985) and included in fall risk assessment tools (Berg, Wood-Dauphinee, Williams, & Maki, 1992; Smith, 1994; Tinetti, 1986). Tiedemann et al (2008) found the sit to stand test with five repetitions was predictive of falls. The sit to stand test is a component of the Short Physical Performance Battery and has been used as an outcome measure in large epidemiological studies (Guralnick et al., 2000; Guralnik et al., 1995).

In the present study, participants were asked to rise from a 43cm chair, five times as fast as possible. Wherever possible, participants were encouraged to fold their arms across their chest and complete the task without arm support. The assessor recorded whether; the participant was able to complete the task (yes/no), required use of arms (yes/no), and time in seconds from the initial to the final seated position after completing five stands (Sherrington, Lord, & Herbert, 2003; Tiedemann et al., 2008).

Activities of daily living and psychosocial questionnaires

The RCT sought primarily to determine whether participation in the exercise programme had an effect on fall risk factors. Questionnaires and self-report scales, which evaluated ADL and psychosocial factors, were also incorporated as secondary outcome measures. These measures were included in an attempt to explore the global impact of the exercises on the participants' lives.

The Lawton-Brody Activities of Daily Living/Instrumental Activities of Daily Living

An assessment instrument which provides self-reported information about functional skills necessary to live in the community. The assessment is intended for use among older adults and commonly used in community settings. It contains eight items investigating instrumental ADL and six items addressing physical self-maintenance (Lawton & Brody, 1969).

Guralnik questionnaire

A questionnaire that measures disability according to difficulty in performing six ADL tasks (Guralnik et al., 1994). The Guralnik questionnaire has been used in large epidemiological studies (Guralnick et al., 2000; Guralnik et al., 1995) .

Self-rated use of mobility aids, balance and fear of falls

Likert scales were used to measure self-rated use of mobility aids indoors and outdoors, balance and fear of falls. The Likert scales were included to gain an understanding of the participants' perception of improvement. These questions have been used in previous studies and have face validity.

Falls Efficacy Scale-International (FES-I)

The Falls Efficacy Scale-International (FES-I) is a widely accepted tool for assessing concern about falling based on the Social Cognitive Theory. The scale was developed and validated by the Prevention of Falls Network Europe (ProFaNE) (Yardley et al., 2005). Studies indicate that the FES-I has excellent validity and reliability (Delbaere et al., 2010; Yardley et al., 2005) across different cultures and languages (Kempen et al., 2007). The FES-I questionnaire contains the 10 items of the original Falls Efficacy Scale (Tinetti et al., 1990), together with six new items. Respondents were asked to rate (on a four point scale) their level of concern about falling when carrying out easy and more demanding physical and social activities.

The Short Form 12-item Survey (SF12)

The present study used the SF12 to investigate QOL. The SF12 is a subset of the Short Form 36-item Survey (Ware, Kosinski, & Keller, 1996). There is good evidence for the reliability, validity and responsiveness of the SF36. However, a potential draw-back is the considerable time required to complete the SF36 questionnaire (Haywood, Garratt, & Fitzpatrick, 2005). Evidence suggests that completion difficulties on QOL instruments increase with age (Haywood et al., 2005). Given that the study population was elderly and participants were asked to complete a number of assessments, the SF-12 was anticipated to be brief, simple to administer and acceptable to respondents.

The SF12 has been widely used as a generic QOL measure (Haywood et al., 2005) and recommended for use in fall prevention studies by the ProFaNE group (Lamb et al., 2005) The SF-12 consists of 12 items and norm-based scoring algorithms, covering the same eight domains as the SF-36, including; what a respondent was able to do, how they felt and how they evaluate their health status. The SF-12 comprises both a physical (PCS-12) and mental (MCS-

12) summary score. There is good evidence for reliability and some evidence for validity of the SF12 (Haywood et al., 2005).

The Physical Activity Questionnaire

In addition to the exercise diaries, all participants undertook The Physical Activity Questionnaire at the baseline and follow-up assessments. This questionnaire by Lord and colleagues (Lord et al., 1993) was used to document the detail (type/volume) of participants' physical activities.

6.4.3 *Adverse events*

Adverse events were defined as any injury or symptom resulting from the trial (exercises or assessment) which restricted physical ADL for 48 hours or longer, or which required medical attention/treatment (Latham et al., 2003). This did not include the delayed onset muscle soreness that is expected with a new exercise programme, unless the pain was extreme enough to limit ADL as above.

Participants were instructed to notify the local physiotherapist and/or researcher of any adverse events. At the classes, the delivering physiotherapist enquired about any adverse events. Physiotherapists were requested to follow the usual HNEAHS procedure for responding to and documenting adverse events. Copies of this procedure were sent to each physiotherapist prior to commencement of the programmes. The physiotherapists were also asked to notify the researcher of adverse events, so details could be recorded and participants followed-up. Information from the self-report fall calendars was also used to monitor for any adverse effects (e.g. an increased fall rate) from the exercise programme.

6.4.4 *Falls*

Participants in both the intervention and control groups were asked to maintain a diary of falls. These records were kept on the self-report calendars (also used to record exercise occasions- [Appendices F.2 and F.3]). Participants were asked to record F on the day of any fall (fell unintentionally to the ground). Falls were recorded for one year after the baseline assessment.

The reverse side of the calendars requested information on the circumstances and consequences of any falls. This page comprised ten questions (five questions for two possible fall events that month). These questions sought the details of any injuries sustained, medical attention required and the cause of the fall.

6.5 Data management and analysis

All the data from the assessments were copied across to a separate electronic questionnaire which was designed and built using Microsoft's InfoPath (InfoPath 2007, Microsoft Corporation, SEA, Washington State, USA). Using the Microsoft Infopath export facility, data from all assessments were transferred to an Excel spreadsheet. The researcher performed data checks to ensure data had been correctly transferred. The data were then imported to SPSS (SPSS 14.0, SPSS Inc., Chicago, IL, USA) for analysis.

All RCT data analysis was carried out according to the pre-established analysis plan and undertaken with the SPSS programme. Descriptive statistics were used to analyse demographic data. Proportions were compared using Chi-squared test, with Fisher's exact test when appropriate. An analysis of covariance was carried out for all continuous outcomes. This involved using baseline performance scores as covariates in the post intervention between-group comparisons. A significant result was defined as a p-value of ≤ 0.05 . A test of the homogeneity of slopes model was applied to all outcome measures which had demonstrated a significant between-group difference. Instances where these tests found significant results are discussed specifically in Chapter 8. Longitudinal analyses were used to assess the changes over time for occasions of general exercise and occasions of home programme.

For the knee extensor strength, Melbourne Edge Test, sway on foam (eyes closed), coordinated stability, and choice stepping reaction time, some data were unobtainable due to impaired participant performance. To enable a score to be allocated, participants unable to complete a test were allocated a score of the mean \pm 3SD for the variable (to approximate the worst score). Walking speed was recorded as the number of seconds taken to walk 10 meters. This variable was recalculated as walking velocity in metres/second. Those unable to complete the task were assigned a velocity of zero. The time taken to stand up five times was expressed as stands per seconds.

In instances where the distribution of the data was skewed, the mean and SD (or 95% CI figures) were presented (i.e. as for non-skewed data). This was because the sample size for these data were sufficiently large that the skewness of the data for the mean should no longer be problematic due to the central limit theorem result, which indicates that as the sample size goes up the normality of the means improves.

Falls were analysed by negative binomial regression using the Stata package (Stata IC9, StataCorp LP, College Station, Texas, USA), adjusting for the number of falls that occurred for each participant in the 12 months prior to the study.

CHAPTER 7: METHODS OF THE EMBEDDED QUALITATIVE STUDY

7.1 Introduction

Chapter 5 presented the methodological rationale of the overall study. It provided an overview of the study's design and described those elements common to both the RCT and embedded study. Chapter 6 discussed specific methodology used in the RCT. From this point, there is a shift in focus. The present chapter examines the specific methodology of the embedded qualitative study. It details the method used to develop an overarching grounded theory. Consideration is also given to the method of data generation, specifically the rationale and process of conducting interviews. As with all qualitative research, it is paramount the 'rigour' of a study be established and this is addressed. At the conclusion of Chapter 7, strategies used to enhance the 'rigour' of the embedded study are discussed (Krefting, 1991).

7.2 Data generation and management

7.2.1 The rationale for using grounded theory as a qualitative method

Qualitative research encompasses a wealth of methods (McMurray, 1994). Each method involves a specific way of thinking about and analysing the data (Richards & Morse, 2007). Grounded theory, developed by two sociologists, Glasser and Strauss (1967) in the 1960s, has gone on to become one of the more influential qualitative methodologies in the social and health sciences (Browne, 2004; Grbich, 1999; Rice & Ezzy, 1999). Later researchers, Strauss and Corbin (1994) defined grounded theory as: "...a general methodology for developing theory that is grounded in data systematically gathered and analysed" (Strauss & Corbin, 1994, p. 273).

Taking a grounded theory approach usually leads to the development of a theory, which explains the study's central story (Browne, 2004), and is specific to the particular process and situation (Polit & Beck, 2004; Richards & Morse, 2007). Grounded theory is a method well suited to everyday life situations where the researcher seeks to explore participant understandings and values, and to learn from participants about a process (Grbich, 1999; Richards & Morse, 2007).

Hence, taking a grounded theory approach fitted the embedded study aim, which was to learn from participants about processes and outcomes of the exercise programme. In particular, the researcher sought to develop a starting theory, to show elements of the process and connection between those elements. It was intended that this theory would increase understanding of the programme, thereby assisting to evaluate, refine and develop it. Grounded theory may be presented in a variety of ways, for example; a narrative statement, a visual picture or a hypothesis (Creswell, 1998). The qualitative results section of this thesis presents the starting theory as a visual picture, detailing the theory's components and conceptual links.

According to Creswell (1998), grounded theory has developed considerably since its inception over four decades ago. Contemporary commentators generally recognise three major Schools of Grounded Theory; the Glaserian or Original Glaser and Strauss School, the Strauss and Corbin School, and the Constructivist Grounded Theory School. Constructivist grounded theory emphasises keeping the research close to participants and maintaining their presence throughout the study. This may be assisted by retaining participants' words intact throughout the analysis process and using creative writing to express how participants constructed their world (Charmaz, 2000; Mills, Bonner, & Francis, 2006).

The Strauss and Corbin School (1990; 1994) incorporated several alterations to the Original Glaser and Strauss School of the 1960's. Their changes were intended to make theories more precise. Of particular note, were the addition of new analytic procedures and a greater emphasis on verification. The Strauss and Corbin School (1990; 1994) was chosen as the basis for the present study because it provides a systematic approach, clear advice on how to structure data and validation criteria. These features explicate construction of the theoretical framework necessary for development of empirically grounded categories (Kelle, 2005), and were anticipated to assist the researcher develop a starting theory.

As outlined earlier, grounded theory is well known for its methods of analysis (Henwood & Pidgeon, 2003; McMurray, 1994). Latter parts of this chapter will expand upon the specific methods of analysis used in the embedded study.

7.2.2 *Rationale for using interviews*

As discussed above, grounded theory is defined more by its analytical procedures than its data collection methods (Charmaz, 2000). When using a grounded theory approach, the researcher may choose from a range of available data gathering techniques, the technique or techniques most appropriate to their study (Henwood & Pidgeon, 2003).

Interviews were selected as the data collection method of the embedded study because they suited its purpose to explore participant and provider views of the exercise programme. Furthermore, it was anticipated that data collected from the interviews would provide an additional 'voice' to data collected from the RCT, thereby enriching the study. According to Streubert, Speziale and Carpenter (2007), interviews fit well with all the Schools of Grounded Theory. They are the most commonly used data gathering method for grounded theory studies (Charmaz, 2006) and qualitative research in health care settings (Britten, 2006). Interviews are also an excellent method for gaining information about events, opinions and experiences (Hay, 2005).

There were no existing interview instruments applicable or adaptable to the research question and study design (Hulley, Cummings, Browner, Grady, & Newman, 2007). So interview schedules specific to the study were developed (Appendices F.4, F.5, F.6 and F.7). Interviews took a semi-structured format. The schedules comprised a combination of open and closed questions. Closed-ended responses permitted tabulation of the number of responses for each alternative, providing an understanding of what the sample as a whole thought of an issue (Polit & Beck, 2004). Open-ended responses provided opportunities for respondents to express their thoughts freely and in their own words, thereby adding depth and richness to the study.

The interview schedules were organised around ordered but flexible questioning (Hay, 2005). Asking the same open-ended questions (with planned probes) across sites permitted comparable data to be gathered, thereby assisting the search for patterns across answers and aiding in triangulation (see section 7.4.8) (Bogdan & Biklen, 1998; Richards & Morse, 2007). At the same time, the open-ended questions permitted respondents to comment freely on their views and experiences (Bogdan & Biklen, 1998; Patton, 2002) and were broad enough to allow detailed and potentially complex answers (Hay, 2005). It was envisaged that responses to these open-ended questions would assist in developing rich, thick categories. Moreover, the combination of open-ended questions and having many voices across sites, was anticipated to assist in achieving saturation of the data (see section 7.4.4) (Richards & Morse, 2007).

7.2.3 *Design of the interview schedule*

Initial drafts of the interview schedules were designed by the researcher. The first was for the participants and the second for volunteer assistants. The third and fourth were for physiotherapists, who were interviewed both before and after the program. Drafts of all four interview schedules were critically appraised by four peers. These peers had an in-depth

understanding of qualitative questionnaire design and a history of published research using higher level qualitative methods. The peer review process (Krefting, 1991) identified problems, for example, with the order and wording of questions. Drafts were fine tuned in response to these peer comments. This process produced a second version of the interview schedules.

Next, the second versions were pilot tested with 'key informants'. Informants (3) were persons with similar characteristics to the prospective participants, volunteer assistants (3), and physiotherapists (3). Informants were selected on the basis that they were culturally qualified to represent the groups being researched (Hay, 2005). It is acknowledged that key informant review can be a useful litmus test of interview design (Hay, 2005). In terms of the interview schedules, informants checked that questions were clear and produced appropriate answers (Hulley et al., 2007). Their feedback was incorporated into the final (third) version of the interview schedules (Appendices F.4-F.7).

During the design and revision phases, the researcher paid careful attention to the content of the schedules and employed acknowledged principles of interview construction. Clarity, simplicity and logic were promoted through careful attention to wording, sequence and format (Hay, 2005; Polit & Beck, 2004). Questions were short, specific and clearly worded (Hulley et al., 2007; Portney & Watkins, 2009). For example, there were minimal uses of vague, complex or technical words, double negatives or double-barrelled questions (de Vaus, 1999; Hulley et al., 2007; Polit & Beck, 2004; Portney & Watkins, 2009). All questions were written in language resembling common speech (Hulley et al., 2007). Questions were grouped together by topic and each topic was introduced with a short descriptive statement. This assisted to create a logical sequence and enhanced content flow (Hulley et al., 2007; Portney & Watkins, 2009).

Topics were investigated by closed or open questions or a combination of the two. In the case of combined questions, the closed response was asked initially to collect numeric data and set the scene. This was followed by an open-ended question which allowed participants to elaborate and promoted an in-depth understanding of the topic.

The closed questions provided response categories of sufficient range to cover all respondents. For each question, a participant could provide only one answer. Response options were balanced in each direction (de Vaus, 1999; Portney & Watkins, 2009). For example, closed questions were frequently presented using a Likert scale with five response categories: strongly agree, agree, neutral, disagree, and strongly disagree. Likert scales are often used to quantify attitudes and health-related quality of life (Hulley et al., 2007). For the purposes of the embedded study, Likert scales provided the advantages of a closed-ended response and a

reasonable range of latitude (DePoy & Gitlin, 2005), together with an ability to measure the direction and intensity of the response (de Vaus, 1999; DePoy & Gitlin, 2005). Some closed questions were dichotomous, for example, a statement to which participants were asked if they agreed or disagreed. These questions permitted an 'unsure' response, in case the question related to an issue on which the participant held no opinion (de Vaus, 1999).

7.2.4 *The interviews*

Face-to-face interviews were conducted with the physiotherapists prior to and following the programme (n= 4, therefore eight interviews were held in total), the volunteer assistants following the programme (n=17) and intervention group participants following the programme (n=70). A quiet and private venue at each site was selected for the interviews. Attention was paid to ensuring participant comfort. During the first few minutes of the interview, the researcher provided an introduction to the nature and purpose of the embedded study, and assurances of confidentiality (Bogdan & Biklen, 1998; Polit & Beck, 2004).

Recording and transcribing are matters of contention in the qualitative research literature (Richards & Morse, 2007). For the purpose of the embedded study, it was anticipated that verbal response data would be rich enough to generate interpretation and support abstraction. It is acknowledged that an audio recorder can sometimes inhibit a participant's responses, because the recorder serves as a reminder of the formal nature of an interview (Hay, 2005). As these were face-to-face interviews, to reduce the likelihood of inhibiting participant comments, the researcher made verbatim (as close to complete as possible) notes of participant comments at the time of interview. Furthermore, she sought clarification from the participant whenever things were unfamiliar (Bogdan & Biklen, 1998).

7.2.5 *Data management*

Written interview records were transcribed verbatim, by the research assistant, to an electronic questionnaire which had been designed and built with Microsoft's InfoPath. The researcher checked these transcripts for accuracy (Richards & Morse, 2007). Using Microsoft InfoPath's export facility, one open question response (at a time) was selected for all participants. For example, all the question one responses were selected and exported to the question one text file. This process was repeated until there was a text file for each question (containing all participant responses to that question). These text files were imported to nVivo (nVivo7, QSR International, Doncaster, Victoria, Australia), using nVivo's import facility. Within nVivo, participant response, number and demographic characteristics were linked electronically.

Responses to the closed-ended interview questions were exported via Microsoft Infopath. Initially, the closed responses for all participants were exported to an Excel spreadsheet. From here the data were imported to SPSS for quantitative analysis.

7.3 Method of data analysis and interpretation

7.3.1 *Sampling procedure*

Grounded theory typically uses theoretical sampling, whereby the researcher deliberately seeks out participants to test the emerging categories and themes (Pope, Ziebland, & Mays, 2006). The present embedded study used a ‘modified grounded theory’ approach which did not incorporate theoretical sampling. This approach was chosen because the overall study design made it difficult to effectively apply theoretical sampling to the embedded study. In particular, logistic constraints led to a fixed assessment and programme (phase) schedule at the various sites (see section 5.6). These factors made it impractical for the researcher to come and go from ‘the field’, seeking participants to test emerging categories and themes. Rather, all intervention participants, physiotherapists and volunteer assistants (n=91) were invited to attend for interview. The inclusion of said persons across all sites and periods of time permitted exploration of the full range of experiences and views (Mathers & Huang, 2004). Moreover, it was anticipated that including all perspectives would assist to fully develop the properties of each category, achieving saturation and maximising differences in the data.

7.3.2 *The data analysis process*

A particular feature of grounded theory, seen by many as a strength, is the provision of a well defined set of steps for analysis (Henwood & Pidgeon, 2003; McMurray, 1994). Ideas are the basic units of analysis. Categories are groups of ideas helpful in explaining the data. Sub-categories are pieces of the key idea in a category (Brown, 2004). The process of coding is a set of procedures for gathering material about the categories (Richards & Morse, 2007). The embedded study utilised constant comparative analysis, and the three types of coding described by Strauss and Corbin (1990; 1994; 1998); open, axial and selective coding. The following section explains each procedure. However, it is important to note that due to the inductive nature of grounded theory, these procedures did not occur in a linear sequence. Rather, the

researcher moved back and forth between the three types of coding and combined them (Flick, 2006).

Constant comparative analysis

Throughout the embedded study, and as part of each type of coding, the researcher compared units of data with other units of data in a process termed constant comparative analysis (Henwood & Pidgeon, 2003; Llewellyn, 1997). Using this technique, the researcher compared each new piece of data with data previously analysed, and asked questions about the similarities and differences between the pieces of data (Streubert Speziale & Carpenter, 2007). Through constant comparative analysis, the researcher revealed and refined categories, explored the diversity within categories, identified links among categories and looked for emerging themes (DePoy & Gitlin, 2005). Thereby, the pieces were inductively fitted together to form a larger puzzle (Llewellyn, 1997) .

Open coding

Open coding was used to ‘open up’ the data and look at it in new ways (Rice & Ezzy, 1999; Richards & Morse, 2007). Through the process of open coding, ideas and relationships were identified and the data were classified into meaningful categories (Browne, 2004; Richards & Morse, 2007).

As is typical in grounded theory studies, the researcher analysed data from the beginning of the study (Streubert Speziale & Carpenter, 2007). Analysis commenced with the researcher immersing herself in the data, reading and re-reading the available interview transcripts (Browne, 2004; Streubert Speziale & Carpenter, 2007). She looked at the data sentence by sentence, breaking it down into units. A code was ascribed to describe what was happening at each unit of data. Ideas were differentiated using constant comparative analysis. These ideas were formed into provisional categories and sub-categories, and a provisional theoretical framework was developed (Llewellyn, 1997).

Axial coding

Whereas the process of open coding had broken the data down, axial coding was used to put the data together again in new ways. During axial coding the categories were refined and developed by working out how the categories linked together and making connections between a category and its sub-categories (Strauss & Corbin, 1990). The researcher proposed connections and tested these by questioning and comparison (Browne, 2004; Creswell, 1998; Rice & Ezzy, 1999). She then returned to the data and consulted the literature, looking for evidence that supported or refuted the proposed connections (Creswell, 1998). At times, a category was

partitioned into two or more sub-categories. At other times two categories were identified as related, and these were subsequently merged (Rice & Ezzy, 1999). The result of axial coding was a more rigorous specification of the categories formed from the open coding (Rice & Ezzy, 1999).

Selective coding

Categories were also compared and a core category (the primary theme) was identified as the phenomenon of interest, the theoretical point of integration for the study (Strauss, 1987). The core category was identified by its centrality, frequent occurrence and strong connections to other categories (Grbich, 1999). The core category was then systematically related to other categories (Strauss & Corbin, 1990). Every relationship was checked and verified. The links between these categories were consolidated and mapped. This process involved re-examining the data set and recourse to the literature (Llewellyn, 1997). The result was a single story line, offering the core idea and its attendant theory as a way of making sense of the data (Richards & Morse, 2007).

7.4 The research process and rigour

Credibility of a research study is important in evaluating its worth. Credibility involves establishing in the reader, confidence in the ‘truth’ of the findings (Lincoln & Guba, 1985). Throughout the research process specific strategies may be used to increase the quality and credibility of qualitative research (DePoy & Gitlin, 2005; Krefting, 1991). However, there is ongoing debate as to the best means of achieving ‘rigour’ and no one set of criteria are suitable for every study (Streubert Speziale & Carpenter, 2007). The following section presents strategies applied to enhance the ‘rigour’ of the embedded study. The researcher combined these strategies with the analysis process detailed above, in an effort to produce a substantiated account and plausible explanation of the relationship between the identified ideas.

7.4.1 Coding

Three techniques were used to enhance the dependability of coding. First, in an effort to increase the consistency of coding, the researcher performed all coding. Second, during analysis, the researcher periodically conducted a code-recode procedure on her data (Krefting, 1991). That is, after coding a section of the data, the researcher would return, some time later, and recode the same data. The coding stripes function in nVivo was used to compare coding in these documents (Richards & Morse, 2007). Third, peer examination was incorporated into the

coding process. Specifically, the researcher discussed the coding process and findings with two impartial peers who had experience in higher level qualitative research methods (Lincoln & Guba, 1985). These peers were called upon to verify that the category system ‘fitted’ the data and the data had been properly ‘fitted into’ the category system (Krefting, 1991; Patton, 2002).

7.4.2 *Audit trail*

The term ‘audit trail’ refers to evidence that a researcher has kept track of research events and decisions (Richards & Morse, 2007). An audit trail substantiates the way a study was conducted and the end-product achieved (Horsburgh, 2003). For example, that the inferences made were logical and the analytic procedures appropriate (Browne, 2004).

The audit trail of the embedded study incorporated detailed records in the form of a study journal (Appendix I.1), annotations (Appendix I.2), memos (Appendix I.3) and conceptual models (Appendix I.4 and I.5). Each was assisted by the use of nVivo 7 software. All components of the audit trail were regularly reviewed, refined and developed. The audit trail ultimately formed a basis for the theoretical explanations which had been grounded in the data (Grbich, 1999).

The reflective study journal

The researcher kept a reflective study journal, which followed the study from beginning to end (Appendix I.1). Entries focused on the embedded study ‘as a whole’. There was also a reflexive element to the journal in that the researcher wrote of her developing thoughts about the study and influence upon it (Richards & Morse, 2007).

The journal contained a broad mix of content. Initial entries focused on the study plans and aims. As the research progressed, entries presented the steps of analysis, explaining when and why they were taken. Using the journal, the researcher documented ideas and reflections that belonged to more than one category. Later entries focused on ideas drawn together to form themes and sub-themes. Final entries focused on development of the theory.

Memos

As part of the data analysis process grounded theory researchers write extended notes called memos (Appendix I.3) (Charmaz, 2006). In the case of the embedded study, the researcher developed a linked memo for each category (or sub-category). The memos contained definitions of the categories and their properties, together with questions and ideas about the data. The process of writing memos assisted the researcher to move across the database, develop ideas

about the data, refine categories, define the relationships among categories (Richards & Morse, 2007) and slowly build explanations (Pope & Mays, 2006). All memos were coded and treated as data (Richards, 2005). Entries in memos were often linked to entries in the reflective study journal.

Annotations

Annotations attached analytical notes to specific points of text (Appendix I.2) (Browne, 2004). They were placed in the documents to record comments, reminders, hunches and insights about words, phrases or ideas of interest (Richards & Morse, 2007). In so doing, ideas about the detail in the text were available whenever the text was seen.

Conceptual models

Conceptual models were used to visually explore the ways in which different ideas and categories related to each other and to the research questions (Appendix I.3) (Bazeley, 2003; Richards & Morse, 2007). All models were archived to provide a record of the research. A 'live' version was also kept to reconsider, refine or extend. As part of the review process, the researcher looked for similarities and differences between models and noted which ideas or categories kept recurring. Most models were accompanied by a linked memo (Bazeley, 2003). These memos served as a means by which the researcher could keep track of ideas and categories displayed in the model, their relationships with each other and the broader aspects of the project.

7.4.3 *Use of software*

nVivo 7 is a software program specifically designed for qualitative data analysis (Pope & Mays, 2006). In the embedded study, nVivo7 was used to assist with data management, and the process of analysis and abstraction (Richards & Morse, 2007). For example; by facilitating data storage (transcripts, ideas and questions), retrieval, comparing, linking (Patton, 2002) categorising and theorising (Browne, 2004). Importantly, nVivo7 functions enabled sections of the data to be linked electronically, which avoided problems of de-contextualisation or data fragmentation (Pope, Ziebland, & Mays, 2000).

7.4.4 *Saturation*

Indicators of saturation are data replication (Morse, 1994), when data provides no new insights (DePoy & Gitlin, 2005) and when data leads to no further categories (Pope & Mays, 2006). With replication comes verification (Richards & Morse, 2007). At the point of saturation, there

is dense and precise information in each category (McMurray, 1994), and the researcher has sufficient information to form an understanding of the phenomenon (DePoy & Gitlin, 2005).

According to Creswell (1998), the qualitative researcher typically conducts 20-30 interviews, with a view to collecting data which will saturate the categories. As previously discussed, the embedded study involved 95 interviews. It was anticipated that the relatively high number of interviews, together with the style of interview questions (refer to sections 7.2.1 & 7.3.2) would assist in achieving saturation, which in fact, it did.

7.4.5 *Discrepant cases*

Real life comprises different perspectives that do not always coalesce. Credibility is increased if the interpretation can explain any apparent contradictions. Therefore, accounting for deviant cases is important (Creswell, 2003; Krefting, 1991).

The researcher sought and described variation in the data as a means of refining analysis. Journal entries recorded discrepant cases (Patton, 2002), those that did not fit the emerging model. Attempts were made to account for these (Richards & Morse, 2007). The process of exploring these different cases led the researcher to disconfirm parts of the model, explore alternate explanations and make new connections (Browne, 2004; Mays & Pope, 2000). This process continued until the researcher was satisfied with the overall picture, thus strengthening the final outcome.

7.4.6 *Member checking*

Member checking involves cross-checking interim findings with respondents (Barbour, 2001) to ensure the data accurately reflects their experience (Creswell, 2003; Lincoln & Guba, 1985), thereby enhancing the 'truth value' of the study. Member checking may also assist in refining explanations (Barbour, 2001) and increasing researcher awareness of their influence on the study (DePoy & Gitlin, 2005).

Member checks were undertaken as part of the embedded study analysis. Individuals were selected (three each of participants, volunteer assistants and physiotherapists) to represent a range of demographic characteristics in the study population. They were initially approached by phone, provided with an explanation and asked if they wished to take part in the member check process. The nine individuals agreed to participate. Each member was sent a summary of the themes and associated sub-themes, together with a diagram of the substantive theory. They were

asked to read and consider the information. Reviews were conducted by telephone. Each member was asked for general comment. The researcher then guided the member systematically through each theme and sub-theme, providing opportunities for comment. The reviews were digitally recorded (with member consent) and later transcribed in full. Member comments were incorporated into the embedded study findings.

7.4.7 Reflexivity

In qualitative research, the researcher is part of the process, not separate from it. Thus it is important that the researcher analyse him or herself in the context of the research (Aamodt, 1982). Reflexivity means sensitivity to, acknowledging and accounting for the ways in which the researcher has influenced a qualitative study (Rice & Ezzy, 1999).

In the embedded study, the researcher used a reflective study journal to describe and interpret her part in the research process. Prior to analysis, she wrote about the personal assumptions she brought to the study and the ways experience might shape her thoughts on the data. Later journal entries recorded her feelings, concerns and reactions to participant comments and steps in the analysis. Writing about these thoughts and feelings assisted the researcher to become aware of her assumptions and influences on the study. Once aware of these influences the researcher was able to consider ways of altering analysis to enhance the credibility of the research (DePoy & Gitlin, 2005; Krefting, 1991).

7.4.8 Triangulation

Triangulation is a powerful means of enhancing the quality and credibility of research. It is based on the idea that providing a number of different 'slices' of data may assist to confirm certain aspects of a study and contribute to the completeness with which the phenomenon was addressed (Bogdan & Biklen, 1998; Draper, 2004; Krefting, 1991; Mays & Pope, 2000). Many types of triangulation exist (Krefting, 1991). Two types of triangulation were incorporated into the embedded study.

First, triangulation of data sources permitted the researcher to draw from different perspectives that focused on the same topic (Richards, 2005). This assisted to build a justification of the themes (Creswell et al., 2003) and develop a more complete understanding of the programme (Krefting, 1991). Multiple data sources were used with respect to: person (interviews with participants, volunteer assistants and physiotherapists) and location (multiple study sites) (Denzin, 1989; Krefting, 1991).

Second, the embedded study interviews incorporated methodological triangulation. Specifically, closed and open-ended questions were incorporated in the one instrument so that quantitative and qualitative data could be collected and considered as a whole.

7.4.9 *Comparing with the literature*

In the embedded study, information and ideas from the literature became data and were integrated into the study. Through constant comparative analysis, the researcher gained an idea of the similarities and differences between the study findings and the literature. This assisted her to fill in missing pieces of the emerging theory (Streubert Speziale & Carpenter, 2007), and validate the accuracy of her findings (Richards & Morse, 2007). Additionally, memos were used to link the data with the literature and record ways that the literature had shaped the researcher's thinking about the data.

7.5 Transferability

In qualitative research, establishing transferability across practice involves showing that findings have applicability to other contexts (Lincoln & Guba, 1985). These authors make the point that while qualitative research is situationally unique, it is transferable when the findings fit into contexts outside the study situation, as determined by the degree of similarity between the two contexts. Moreover, Lincoln and Guba (1985) suggest that transferability is not so much the responsibility of the researcher as the person wanting to transfer the findings to another situation. Hence, the original researcher will have addressed the issue of transferability, if they have provided adequate descriptive information about the respondents and setting to permit transferability judgements to be made by others.

7.6 Summary

Chapter 7 explicated the methods of the embedded study. A rationale for and explanation of the method of data generation was provided. Grounded theory methodology was discussed with reference to the embedded study. The chapter concluded with a description of techniques used to enhance the 'rigour' of the embedded study. With reference to the methods outlined in this chapter, Chapter 9 presents the findings of the embedded qualitative study.

PART C

THE RESULTS AND FINDINGS

Chapter 8: Results of the Randomised Controlled Trial

Chapter 9: Findings of the Embedded Qualitative Study

CHAPTER 8: RESULTS OF THE RANDOMISED CONTROLLED TRIAL

This chapter describes the study population by presenting findings from the baseline assessments. It then reports the effect of the intervention on primary and secondary outcome measures. Data on home programme compliance, general exercise levels and fall incidence are also presented. The chapter concludes with a comparison of primary outcome measures by study site.

8.1 Baseline participant characteristics

One hundred and forty-seven participants were randomised. A summary of participant characteristics at baseline can be found in Table 8-1 and Table 8-2. Groups were similar for all baseline variables, indicating successful randomisation.

Table 8-1: Summary of demographic characteristics

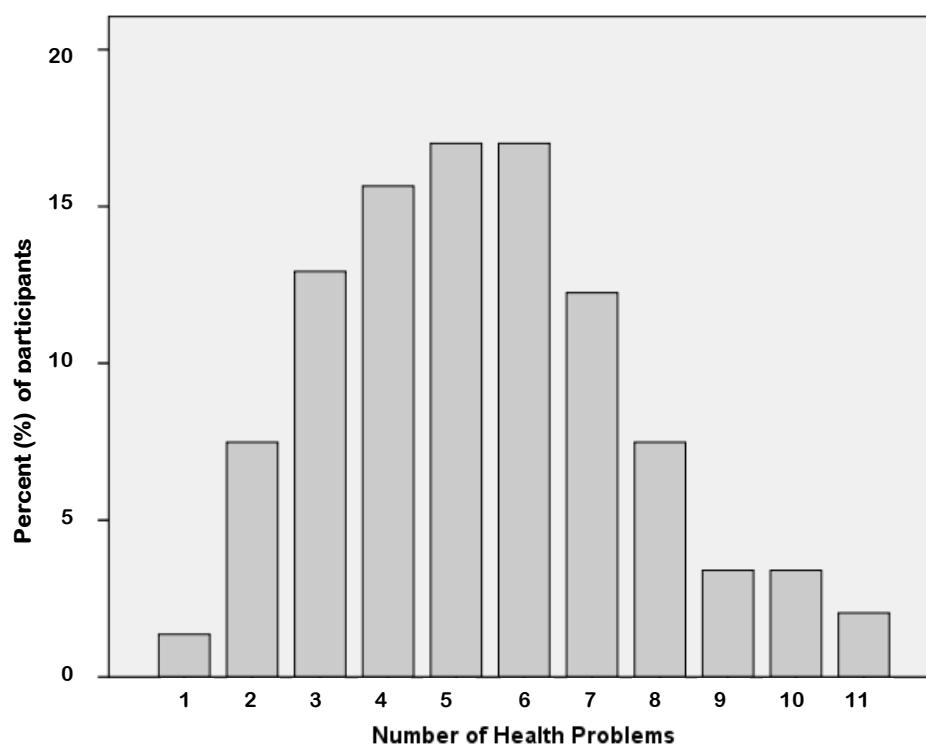
	Control group (n=73)	Intervention group (n=74)
Females (%)	59.0 (81%)	62.0 (84%)
Age (years) (mean (SD))	76.7 (8.8)	76.6 (6.9)
Height (cm) (mean (SD))	161.9 (8.4)	161.5 (8.4)
Weight (kg) (mean (SD))	72.3 (15.9)	74.8 (18.6)
Number of medications (mean (SD))	5.0 (4.1)	4.9 (3.4)
Four or more medications (number (%))	45.0 (62%)	45.0 (61%)
Co-morbidities (mean (SD))	5.3 (2.4)	5.4 (2.1)
Four or more co-morbidities (number (%))	55.0 (75%)	60.0 (81%)
Falls in past year (mean (SD))	1.15 (2.2)	1.18 (2.3)
SPMSQ (adjusted errors) (mean (SD))	0.4 (0.7)	0.5 (0.6)
Fell in last year (%)	39.0 (53%)	35.0 (47%)
Fall related injury affected mobility (%)	5.0 (7%)	9.0 (12%)

SPMSQ-Short Portable Mental Status Questionnaire

Table 8-2: Age subgroups (%)

	Control group (n=73)	Intervention group (n=74)	Total (n=147)
74 years or less	27 (37%)	25 (34%)	52 (35%)
75 to 84 years	34 (47%)	39 (53%)	73 (50%)
85 years and above	12 (16%)	10 (14%)	22 (15%)

The mean age for the population was 77 years (SD 6.8) and 121 participants (82%) were female. One hundred and fifteen participants (78%) had four or more co-morbidities (Figure 8-1), and they took an average of 5.0 (SD 3.8) medications (Figure 8-2). The breakdown of medications by therapeutic class is provided in Table 8-3. Fifty percent of the population (74 participants) had fallen at least once in the year prior to commencement of the study. The mean Short Portable Mental Status Questionnaire adjusted score was 0.4 errors (SD 0.6), with a range from 0 to 4. Sixty-eight participants (46%) rated their balance as fair or poor. To mobilise outdoors 108 (74%) used no aids, 27 (18%) used one stick and 12 (8%) used a frame.

**Figure 8-1: Number of health problems by percent of sample (n = 147)**

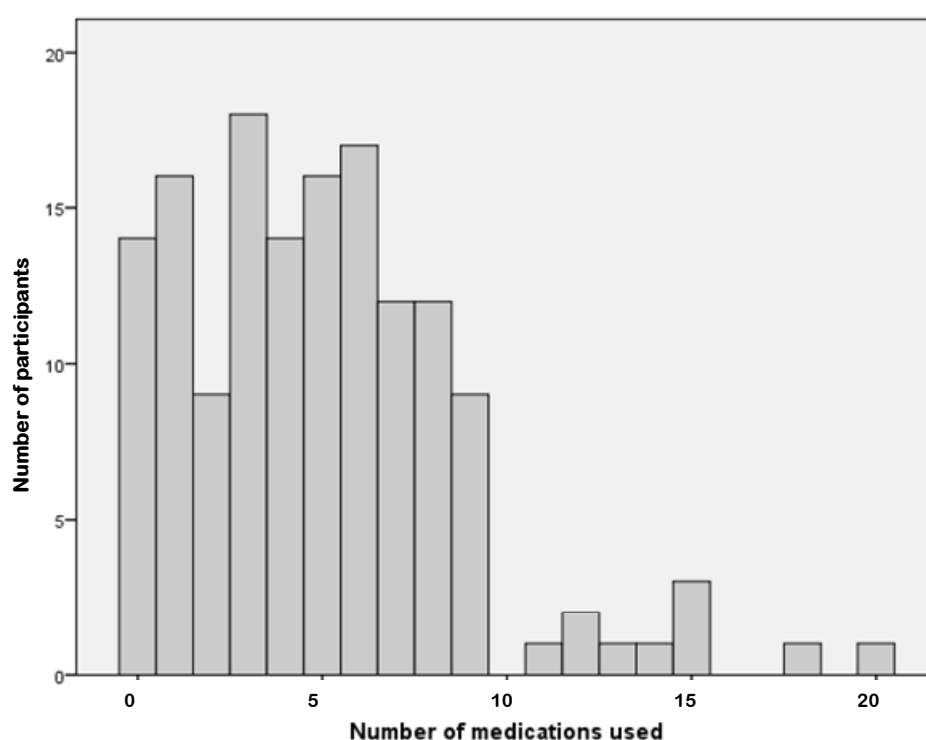


Figure 8-2: Number of medications used (n = 147)

Table 8-3: Number of participants on one or more medication in each therapeutic class (%)

Medication class	Control (n=73)	Intervention (n=74)	Total
Alimentary system	28 (38%)	17 (23%)	45 (31%)
Allergic disorders	0 (0%)	1 (1%)	1 (1%)
Analgesia	23 (31%)	33 (45%)	56 (38%)
Cardiovascular system	57 (77%)	53 (73%)	110 (75%)
Central nervous system	15 (20%)	19 (26%)	34 (23%)
Ear, nose, oropharynx	1 (1%)	0 (0%)	1 (1%)
Endocrine & metabolic disorders	39 (53%)	32 (44%)	71 (48%)
Eye	6 (8%)	2 (3%)	8 (5%)
Genitourinary system	4 (5%)	1 (1%)	5 (3%)
Infections and infestations	7 (9%)	3 (4%)	10 (7%)
Musculoskeletal system	14 (19%)	21 (29%)	35 (24%)
Neoplastic disorders	3 (4%)	2 (3%)	5 (3%)
Nutrition	6 (8%)	7 (10%)	13 (9%)
Respiratory system	4 (5%)	13 (18%)	17 (12%)
Skin	3 (4%)	2 (3%)	5 (3%)
Vitamins and minerals	14 (19%)	16 (21%)	30 (20%)
No medications used	6 (8%)	8 (11%)	14 (10%)

Of the study population, one hundred and thirty six people (93%) lived independently in the community, with the remaining 11 participants (7%) residing in hostel accommodation. One hundred and fourteen participants (78%) lived alone. One hundred and eight people (73%) lived within 5 kilometres of the programme venue (Table 8-4). The proportion of control to

intervention participants was roughly equal at each site (Table 8-5). The sample was divided approximately equally between small, medium and large rural population centres. That is, 51 participants came from the smaller centres (Bingara 1,207 and Quirindi 2,924), 47 participants came from the two medium population centres (Inverell 15,509 and Muswellbrook 15,237) and 49 participants were from the large population centre (Tamworth 53,590).

Table 8-4: Living circumstances (%)

Characteristic	Control group (n=73)	Intervention group (n=74)
Type of accommodation		
Hostel	6 (8%)	5 (7%)
Independently	67 (92%)	69 (93%)
Living companion(s)		
Alone	60 (82%)	54 (73%)
Spouse	5 (9%)	7 (10%)
Other	8 (11%)	13 (17%)
Distance from study site		
<5km	52 (71%)	56 (76%)
5-10km	14 (19%)	10 (14%)
11-20km	4 (6%)	4 (5%)
>20km	3 (4%)	4 (5%)

Table 8-5: Sample breakdown by study site

Number of participants	Bingara	Inverell	Muswellbrook	Quirindi	Tamworth
Control	9	16	7	17	24
Intervention	7	16	8	18	25
Total	16	32	15	35	49

The baseline assessment measured fall risk factors, mobility and psychosocial parameters.

Performance at baseline is shown in Table 8-6, Table 8-7, Table 8-8, Table 8-9, Table 8-10 and Table 8-11.

Table 8-6: Physiological Profile Assessment results

Outcomes	Control group (n=73 at baseline and 65 at post intervention)	Intervention group (n= 74 at baseline and 69 at post intervention)	Mean difference at post intervention adjusted for initial scores (95% CI)*	P-value
Falls risk score				
Baseline	1.27 (1.52)	1.36 (1.47)	-0.44 (-0.78 to -0.10)	0.012
Post intervention	1.02 (1.35)	0.60 (0.98)		
Average knee extensor strength (kg)				
Baseline	25.8 (9.5)	24.2 (9.1)	2.63 (0.81 to 4.45)	0.005
Post intervention	26.4 (9.7)	27.7 (9.0)		
Sway on floor-eyes open (mm)				
Baseline	108.0 (58.9)	111.9 (56.4)	2.13 (-15.42 to 19.67)	0.811
Post intervention	89.0 (50.0)	92.8 (63.7)		
Sway on floor-eyes closed (mm)				
Baseline	135.5 (88.1)	149.4 (87.1)	-14.30 (-41.75 to 13.16)	0.305
Post intervention	126.3 (75.0)	118.0 (96.0)		
Sway on foam-eyes open (mm)				
Baseline	221.0 (134.6)	267.5 (153.4)	-12.78 (-40.07 to 14.51)	0.356
Post intervention	165.2 (82.2)	156.0 (77.9)		
Sway on foam-eyes closed (mm)				
Baseline	388.1 (179.2)	430.9 (251.4)	-74.73 (-122.16 to -27.30)	0.002
Post intervention	378.2 (165.2)	310.8 (124.6)		
Melbourne edge test ^a				
Baseline	20.2 (3.8)	20.7 (3.1)	0.18 (-0.43 to 0.79)	0.557
Post intervention	20.83 (3.6)	21.30 (2.7)		
Proprioception ^a				
Baseline	2.1 (1.3)	2.1 (1.5)	-0.37 (-0.83 to 0.10)	0.122
Post intervention	1.9 (1.5)	1.5 (1.3)		
Hand reaction time ^a				
Baseline	301.6 (101.6)	297.4 (82.5)	-30.17 (-57.65 to -2.68)	0.032
Post intervention	312.5 (112.5)	281.5 (60.6)		

* Between-groups difference in week 14 values adjusting for week 0 values

^a Intervention group at follow-up (n=70)

Table 8-7: Berg Balance Scale results

Outcomes	Control group (n=73 at baseline and 65 at post intervention)	Intervention group (n= 74 at baseline and 69 at post intervention)	Mean difference at post intervention, adjusted for initial scores (95% CI)	P-value
Berg Balance Scale total score (0-56) ^a				
Baseline	51.8 (4.9)	50.8 (6.3)	0.99 (0.03 to 1.95)	0.043
Post intervention	52.9 (4.9)	53.0 (4.7)		
Standing functional reach (cm) ^b				
Baseline	22.3 (7.5)	19.6 (5.97)	1.19 (-0.89 to 3.27)	0.259
Post intervention	23.2 (6.3)	22.6 (7.2)		
Turning 360 degrees (seconds)				
Baseline	0.46 (0.22)	0.43 (0.21)	0.04 (-0.01 to 0.09)	0.122
Post intervention	0.44 (0.19)	0.46 (0.22)		
Alternate foot on stool (number in 20 seconds)				
Baseline	12.1 (4.99)	12 (5.9)	0.45 (-1.11 to 2.02)	0.567
Post intervention	13.2 (5.4)	13.6 (5.7)		
Standing on one foot (seconds to max. of 10) ^a				
Baseline	7.5 (3.6)	7.1 (4.0)	1.05 (0.03 to 2.08)	0.044
Post intervention	7.5 (3.9)	8.0 (3.4)		

^a Skewed distribution –between-group differences are those for the change from baseline to post intervention

^b Intervention group at follow-up (n=70)

Table 8-8: Standing balance and other measures of mobility

Outcomes	Control group (n=73 at baseline and 65 at post intervention)	Intervention group (n= 74 at baseline and 69 at post intervention)	Mean difference at post intervention, adjusted for initial scores (95% CI)	P-value
Standing balance				
Maximal balance range (mm) ^a				
Baseline	156.2 (38.95)	157.7 (50.0)	3.23 (-10.11 to 16.57)	0.633
Post intervention	162.7 (42.7)	164.4 (50.2)		
Co-ordinated stability ^b				
Baseline	34.7 (11.3)	34.5 (13.9)	0.50 (-2.37 to 3.37)	0.731
Post intervention	35.5 (12.2)	35.6 (11.6)		
Other measures of mobility				
CSRT (seconds) ^c				
Baseline	39.05 (16.90)	43.23 (19.77)	-4.16 (-7.87 to -0.45)	0.028
Post intervention	36.81 (17.42)	35.08 (10.97)		
Gait velocity (m/sec)				
Baseline	1.10 (0.34)	1.10 (0.35)	0.01 (-0.07 to 0.09)	0.796
Post intervention	1.17 (0.34)	1.17 (0.38)		
Sit to stand (stand/sec)				
Baseline	0.31 (0.10)	0.29 (0.10)	0.02 (-0.01 to 0.05)	0.139
Post intervention	0.32 (0.10)	0.32 (0.10)		

^a Control group at follow-up (n=64)

^b Skewed distribution –between-group-differences are those for the change from baseline to post intervention

^c Control at baseline (n=71) & follow-up (n=63); Intervention group at baseline (n=70) & follow-up (n=68)

CSRT-Choice Stepping Reaction Time

Table 8-9: Self-reported measures of health and physical activity

Outcomes	Control group (n=73 at baseline and 65 at post intervention)	Intervention group (n= 74 at baseline and 71 at post intervention)	Mean difference at post intervention, adjusted for initial scores (95% CI)	P-value
SF-12 Health Survey				
SF12 (PCS)				
Baseline	41.58 (10.97)	39.28 (10.87)	1.65 (-1.22 to 4.52)	0.257
Post intervention	42.06 (10.81)	41.93 (11.20)		
SF12 (MCS)				
Baseline	54.06 (7.76)	55.17 (8.67)	0.22 (-2.27 to 2.72)	0.861
Post intervention	55.07 (7.57)	55.74 (8.24)		
Physical Activity Survey				
Moderate to vigorous physical activity				
Baseline	10.31 (5.64)	9.56 (6.10)	0.424 (-1.228 to 2.076)	0.612
Post intervention	11.54 (5.76)	11.61 (5.81)		
All physical activity				
Baseline	28.93 (11.59)	28.10 (11.94)	-0.338 (-3.071 to 2.395)	0.807
Post intervention	32.16 (11.04)	31.41 (11.57)		
PCS-Physical Component Summary				
MCS-Mental Component Summary				

Table 8-10: Self-reported fear of falling and balance

Outcomes	Control group (n=73 at baseline and 65 at post intervention)	Intervention group (n= 74 at baseline and 71 at post intervention)	Between-group difference	P-value
Self-reported fear of falling				
FES-I				
Baseline	28.9 (11.6)	28.6 (11.2)		0.813
Post intervention ^a	26.1 (8.1)	26.3 (9.5)	0.27 (-2.56 to 2.01)	
Fear of falls				
Baseline				
Not at all-a bit: moderately-extremely	42 (58%): 31 (42%)	38 (51%): 36 (49%)		
Post intervention				
Poor-fair: good-excellent	44 (68%): 21 (32%)	46 (65%): 25 (35%)		
Proportion of people who improved ^b	17 (26%)	28 (39%)	2.704, 1	0.100
Self-reported balance				
Baseline				
Poor-fair: good-excellent	35 (48%): 38 (52%)	33 (45%): 41 (55%)		
Follow-up				
Poor-fair: good-excellent	29 (44%): 36 (56%)	25 (35%): 46 (65%)		
Proportion of people who improved ^b	21 (32%)	28 (39%)	0.748, 1	0.387

^a Mean difference in scores at post intervention, adjusted for initial scores (95% CI)

^b Between-group difference in proportion of people who improved, Pearson Chi-Square, df

Table 8-11: Self-reported measures of ADL

Outcomes	Control group (n=73 at baseline and 65 at post intervention)	Intervention group (n= 74 at baseline and 71 at post intervention)	Between-group difference	P-value
Self-reported measures of ADL				
Lawton Brody				
Baseline	14.5 (2.7)	14.6 (2.1)		0.293
Post intervention ^a	14.7 (2.6)	14.9 (1.8)	0.21 (-0.19 to 0.61)	
ADL Guralnik				
Baseline	11.4 (1.4)	11.1 (1.6)		0.603
Post intervention ^a	11.4 (1.3)	11.3 (1.5)	0.14 (-0.38 to 0.66)	
Sit to stand (X5)^c				
Baseline				
Unable: with hands: without hands	1 (1%): 11 (15%): 61 (84%)	2 (3%): 15 (20%): 57 (77%)		
Follow-up				
Unable: with hands: without hands	1 (2%): 9 (14%): 55 (85%)	0 (0%): 12 (17%): 57 (83%)		
Proportion of people who improved ^b	3 (5%)	7 (10%)	1.482, 1	0.223*
Walking aid indoors				
Baseline				
Nil: stick: frame	63 (86%): 7 (10%): 3 (4%)	63 (85%): 7 (10%): 4 (5%)		
Follow-up				
Nil: stick: frame	58 (89%): 4 (6%): 3 (5%)	61 (86%): 3 (4%): 7 (10%)		
Proportion of people who improved ^b	2 (3%)	4 (6%)	0.499, 1	0.480*
Walking aid outdoors				
Baseline				
Nil: stick: frame	56 (77%): 14 (19%): 3 (4%)	52 (70%): 13 (18%): 9 (12%)		
Follow-up				
Nil: stick: frame	52 (80%): 10 (15%): 3 (5%)	53 (75%): 11 (16%): 7 (10%)		
Proportion of people who improved ^b	2 (3%)	7 (10%)	2.526, 1	0.112*

^a Skewed distribution –between-group-differences are those for the change from baseline to post intervention expressed as mean (95% CI)

^b Between-group difference in proportion of people who improved; Pearson Chi-Square, df

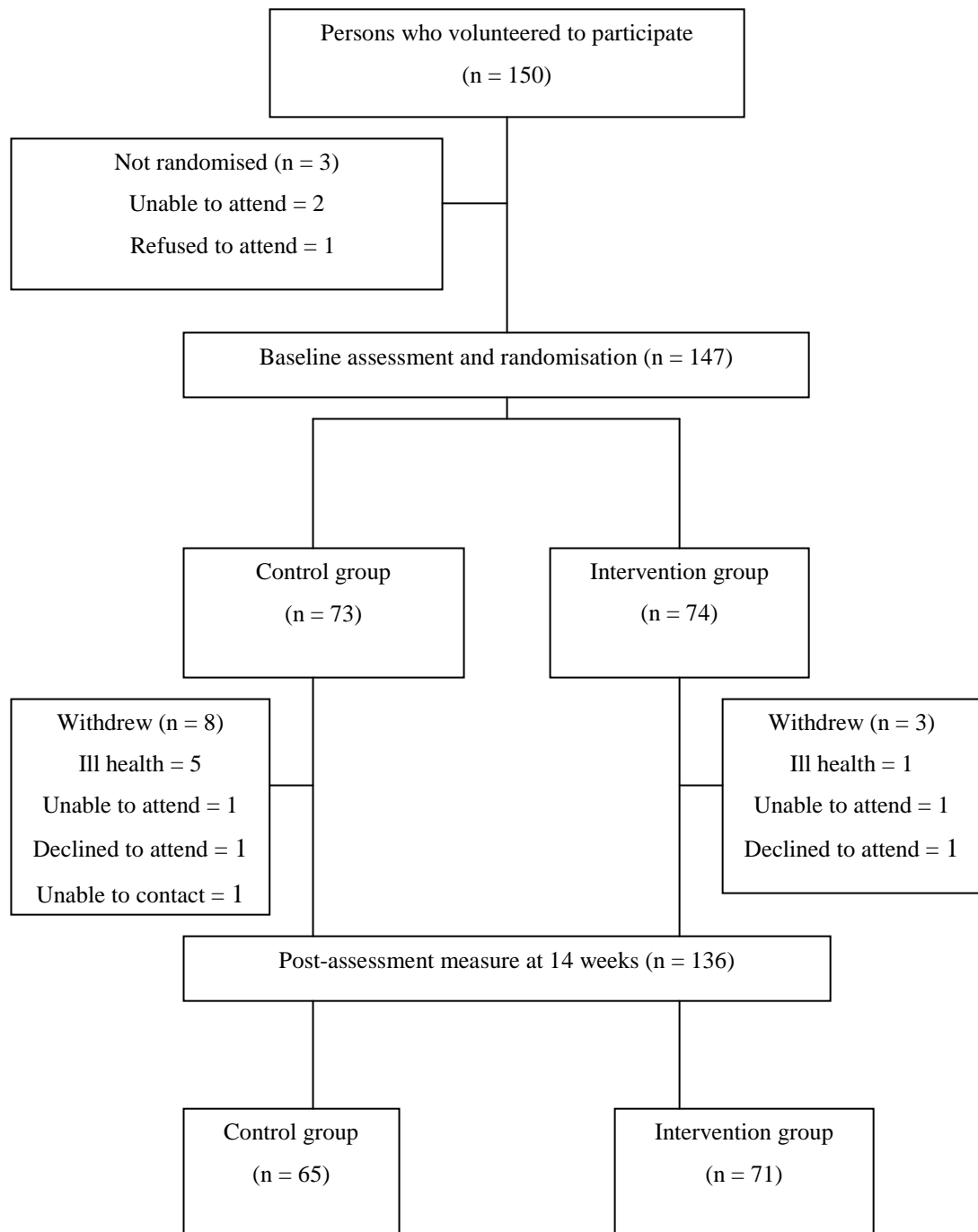
^c Intervention group at follow-up (n=69)

8.2 Completion rates

8.2.1 RCT design and randomisation

Figure 8-3: Participant flow through the RCT

The RCT randomisation process is illustrated below.



8.2.2 *Follow-up assessments*

At the end of the 13 week exercise period 11 participants did not attend the follow-up assessment (eight from the control and three from the intervention group). From the control group; one was unavailable to attend the assessment, five did not attend the assessment due to ill health, one declined to attend and one was unable to be contacted. From the intervention group; one was unavailable to attend the assessment, one did not attend the assessment due to ill health, and one declined to attend. These figures represent a drop-out rate of 7% (11/147) for the follow-up assessments. The figures are well within the acceptable range of drop-outs for this type of trial (Maher, Sherrington, Herbert, Moseley, & Elkins, 2003). The power analyses for this trial had allowed for a 17.5% drop-out rate.

8.2.3 *Self-report calendars*

Some fall and exercise data were provided by 146 of the 147 participants. Full information was available for 139 participants (95%). Partial information was available for the remaining seven participants (5%) (4 control and 3 intervention). Reasons for not providing full information were illness (4), loss of contact (2) and refusal (2).

8.2.4 *Home programme compliance*

Home programme compliance was calculated as weekly occasions of home programme performance (total occasions of home programme for a month divided by 30 and multiplied by 7). Figure 8-4 shows the average weekly occasions of home exercise programme over the one year follow-up period. An interesting finding was the average weekly occasions of home exercise programme reduced steadily from the fourth month.

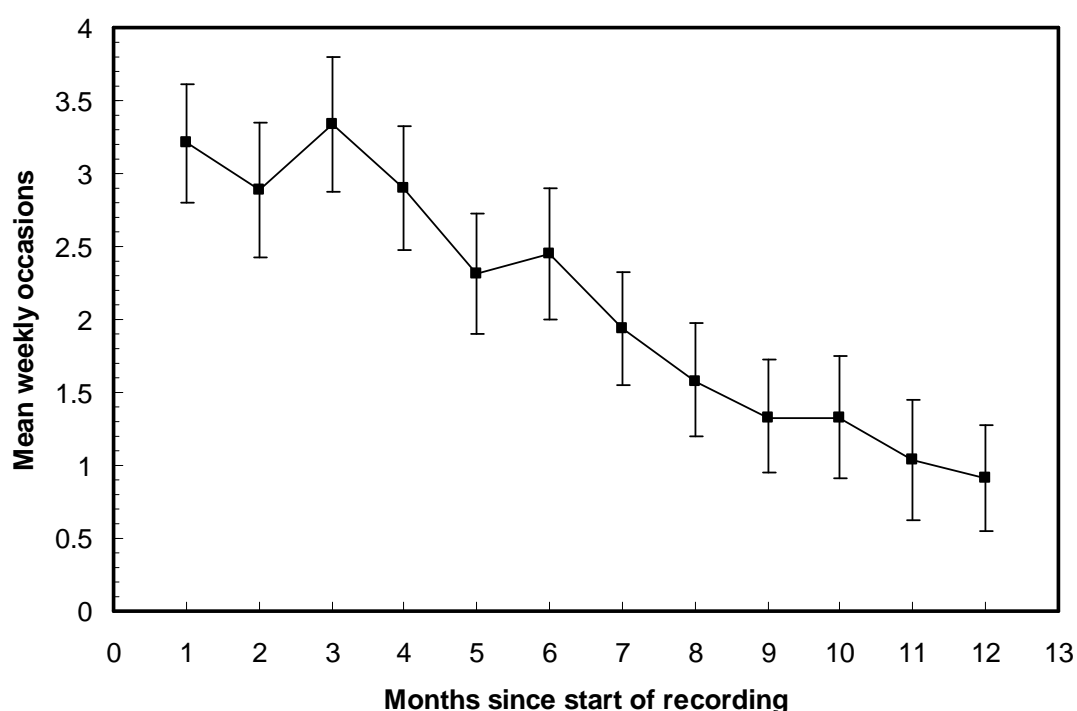


Figure 8-4: Mean weekly occasions of home programme for the intervention group (error bars represent 95% CI)

Longitudinal analysis confirmed there was a significant change over the course of the year in mean monthly occasions of home exercise ($F(11,309) = 9.72, p < .0001$). Follow-up tests comparing the means for each month showed that the fifth month was significantly different to each of first four months (see the Table of differences between means (Appendix H.1)). Other differences of interest between the means for each month can be explored using the table of differences between means (Appendix H.1).

8.2.5 Attendance

While it was intended that the exercise classes be offered once per week over a 13 week period, service delivery was dependent on a number of factors, such as staff availability and the occurrence of public holidays. Consequently, the number of programme weeks and attendance rates varied among sites (Table 8-12). Length of programme reflects the amount of time the programme was offered. Programme attendance shows the median attendance at the programme.

Table 8-12: Programme length and attendance

	Median	Inter quartile range	Minimum	Maximum
Length of programme (weeks) (n=71)	12	2	8	13
Programme attendance (weeks) (n=71)	10	3	1	13

8.3 Primary outcome measures

The 13 week intervention significantly impacted on both of the primary outcome measures, indicating an improvement in balance and a reduction in falls risk score.

8.3.1 Composite PPA falls risk score

On average, the falls risk score for the treatment group was 0.44 more than the reduction in the control (95% CI = 0.10 to 0.78, $p=0.012$) (Table 8-6 and Figure 8-5). There was no indication that improvement was dependent on baseline performance as a test of the homogeneity of slopes model was not significant.

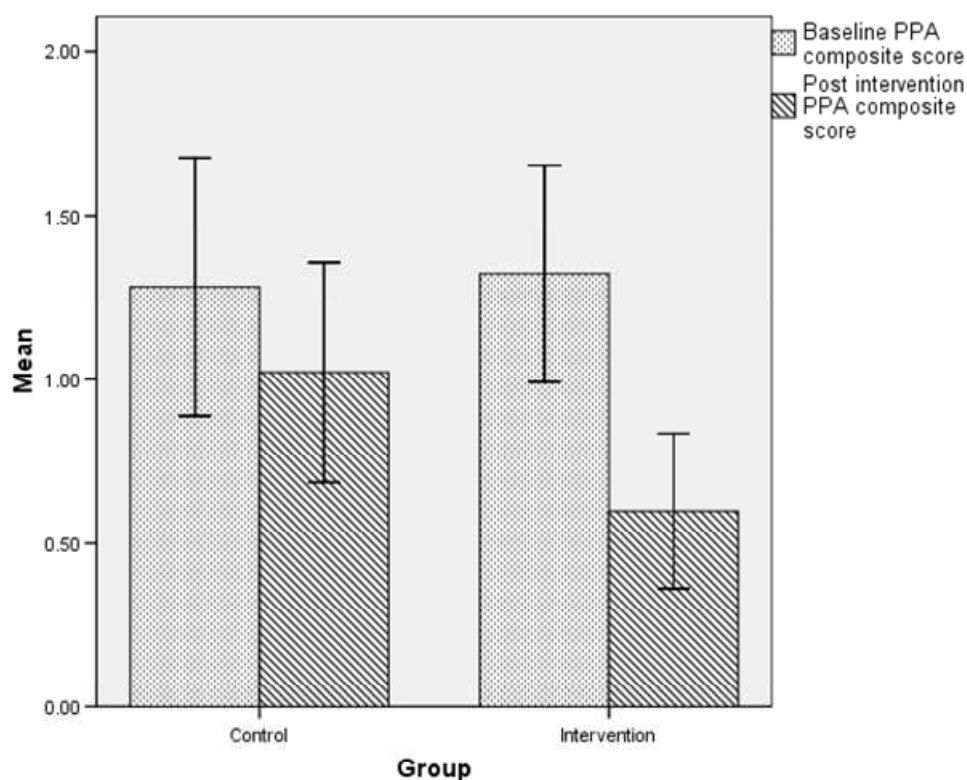


Figure 8-5: Change in PPA composite scores (mean) from baseline to post intervention (error bars = 95% CI)

8.3.2 Berg Balance Scale total score

There was an average increase in the total Berg Balance score for the intervention (0.99) relative to the control group (95% CI = 0.03 to 1.95, $p=0.043$) (Table 8-7). In this case a positive score shows improvement. The assumption of homogenous slopes was tested by fitting a model with an interaction term between pre-score and the grouping variable. Three effects were significant; baseline score ($p < .001$), group by baseline interaction ($p = 0.002$) and the group effect ($p = 0.001$). Consequently, as the interaction term was significant, the best model for the Berg Balance Scale total score is the model of non-parallel slopes. According to this model, the size of the improvement is dependent on the baseline score for the participant (Figure 8-6). For example, for a baseline score of 40 the treatment group improved an average of 4.1 units more than the control group. However, at 50 units the improvement was 1.4 units (Table 8-13). These differences correspond to the distance between the two fitted lines in Figure 8-6 at their respective baseline scores. It is unclear whether this is the result of a ceiling effect due to the measure used (the maximum score on the Berg Balance Scale is 56).

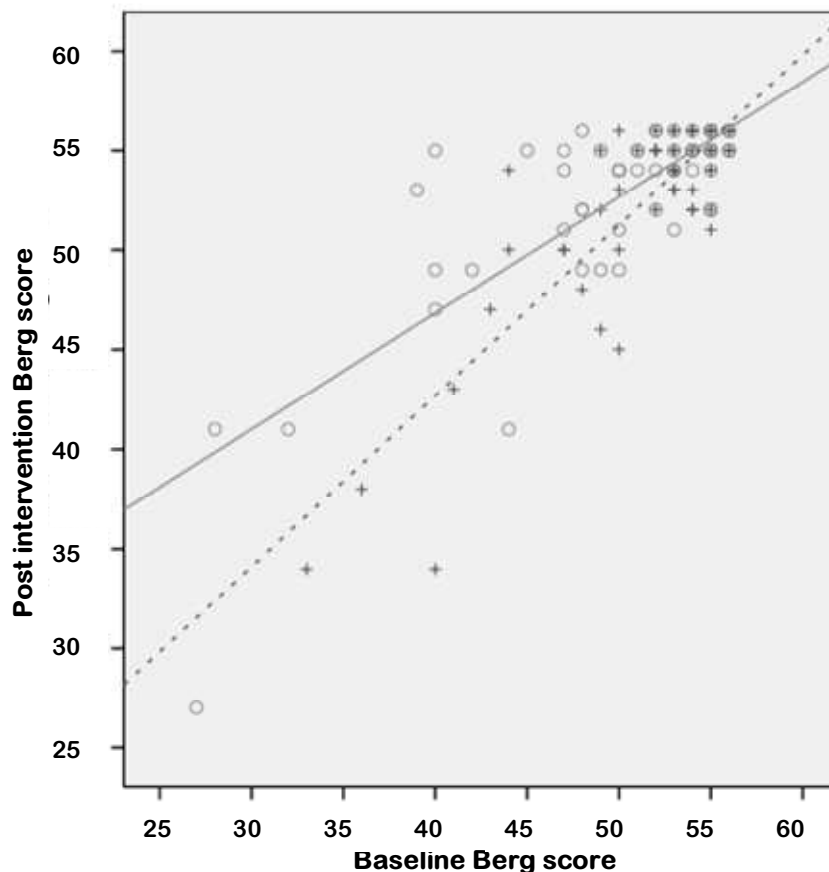


Figure 8-6: Relationships between post intervention Berg Balance Scale total score and baseline values for control (+) and intervention (o) groups. Lines represent post intervention score regressed against baseline score for control group (dashed line) and post intervention score regressed against baseline score for intervention group (solid line)

Table 8-13: Predicted values for baseline Berg Balance Scale total score (T=Treatment, C=Control)

Baseline score	Predicted values		Difference (T-C)
	Control	Treatment	
30	34.1	41.0	6.9
40	42.7	46.8	4.1
50	51.2	52.6	1.4

8.4 Secondary outcome measures

Individual components of the PPA and Berg Balance Scale were included as secondary outcome measures in an attempt to explain changes in the primary outcome measures (Table 8-6 and Table 8-7). Additional secondary outcome measures were included to assess the impact of the exercise programme on variables important for daily function and fall risk.

8.4.1 PPA and Berg Balance Scale component tests

There were significant between-group differences after the intervention for improvements in the PPA component tests of average knee extensor strength (mean=2.63, CI=0.81 to 4.45, $p=0.005$), and hand reaction time (mean= -30.17, CI= -57.65 to -2.68, $p= 0.032$) (Table 8-6). The Melbourne Edge Test for contrast sensitivity and the test for proprioception did not change significantly over time (Table 8-6). However, these were not expected to change in response to an exercise programme.

As this was a community sample, most people were able to complete the four tests of sway without difficulty. There were no significant between-group differences under the first three conditions (standing on the floor with eyes open and closed, standing on foam with eyes open) (Table 8-6). The fourth condition (standing on foam with eyes closed) is the most challenging. Interestingly there was an average reduction in sway distance for the intervention group (-74.73 mm) relative to the control group (Table 8-6). In this case a negative score shows improvement. The assumption of homogenous slopes was tested by fitting a model with an interaction term between pre score and the grouping variable. Two effects were significant; baseline score ($p < .001$) and group by baseline interaction ($p = 0.02$), and the group effect was not significant ($p = 0.47$). Consequently as the interaction term was significant, the best model for sway distance (on foam with eyes closed) is the model of non-parallel slopes. According to this model, the size

of the improvement is dependent on the baseline score for the participant (Figure 8-7). There was a greater effect of the intervention in those with poorer baseline scores.

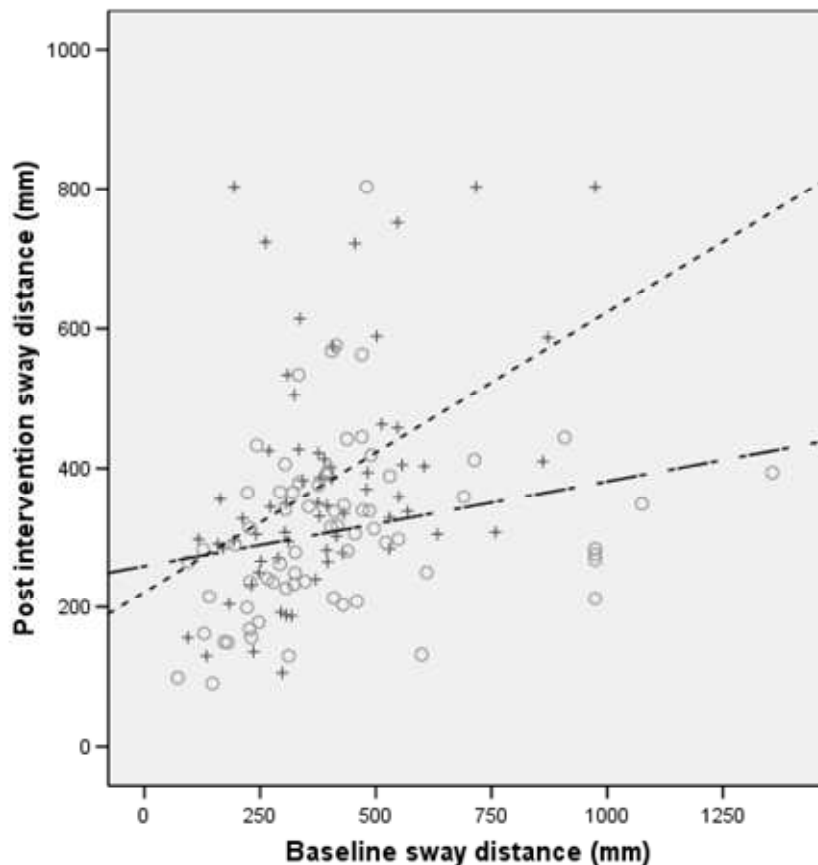


Figure 8-7: Relationships between post intervention sway distance eyes closed (mm) and baseline values for control (+) and intervention (o) groups. Lines represent post intervention score regressed against baseline score for control group (dashed line) and post intervention score regressed against baseline score for intervention group (solid line)

As well as scoring the total Berg Balance Scale, four additional secondary outcome measures were gathered from the Berg. There was a significant between-group difference after the intervention for the Berg component test of standing on one foot (mean=1.05, CI =0.03 to 2.08, $p=0.044$). There were no significant differences for three other Berg component tests; standing functional reach, turning 360 degrees and alternate foot placement on a stool (Table 8-7).

8.4.2 Additional physical tests

There were no significant between-group differences for maximal balance range, coordinated stability, gait (10m) or timed sit to stand (5 repetitions) tests (Table 8-8). There was an average reduction in Choice Stepping Reaction Time (CSRT) for the intervention (-4.16 seconds) relative to the control group (Table 8-8). In this case a negative score shows improvement. The assumption of homogenous slopes was tested by fitting a model with an interaction term between pre-score and the grouping variable. Three effects were significant; baseline score ($p < .001$), group by baseline interaction ($p < .001$) and the group effect ($p < .001$). Consequently, as the interaction term was significant, the best model for CSRT time is the model of non-parallel slopes. According to this model, the size of the improvement is dependent on the baseline score for the participant (Figure 8-8, Table 8-14).

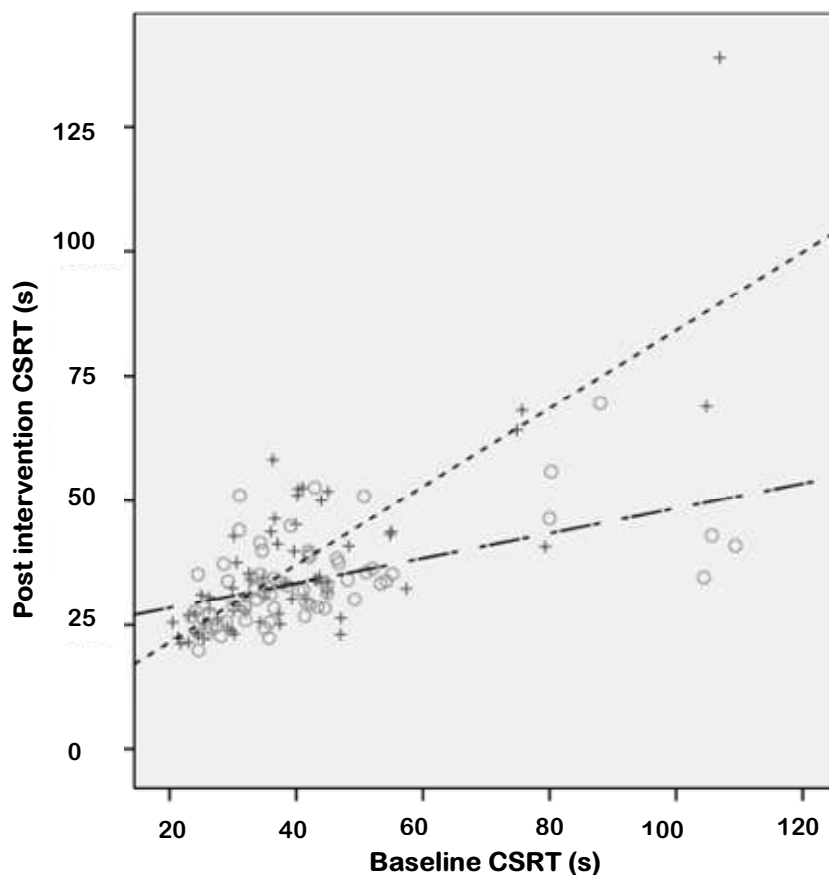


Figure 8-8: Relationships between post intervention CSRT (seconds) and baseline values for control (+) and intervention (o) groups. Lines represent post intervention score regressed against baseline score for control group (dashed line) and post intervention score regressed against baseline score for intervention group (solid line)

Table 8-14: Predicted values for baseline CSRT (seconds) (T=Treatment, C=Control)

Baseline score	Predicted values		
	Control	Treatment	Difference (T-C)
30	29.3	31.0	1.6
40	37.2	33.5	-3.7
50	45.0	36.0	-9.0
60	52.8	38.5	-14.4
70	60.6	41.0	-19.7

8.4.3 *Activities of daily living and psychosocial questionnaires*

There were no significant between-group differences in reported performance of ADL on the questionnaires (Lawton-Brody, Guralnik, and self-rated mobility/use of walking aid) (Table 8-11). There were no significant between-group differences for the SF-12 (Table 8-9) or FES-I (Table 8-10). While, the five point Likert scales for self-rated fear of falls and balance did not show a significant between-group difference, they did indicate a trend towards improvement; 17 (26%) of control participants and 28 (39%) of intervention participants were less fearful of falling and 21(32%) of control participants and 28 (39%) of intervention participants reported improved balance (Table 8-10).

8.4.4 *Occasions of general exercise*

General exercise occurrence was calculated as weekly occasions of general exercise (total occasions of 'E' for a month divided by 30 and multiplied by 7). Figure 8-9 shows the mean weekly occasions of exercise programme performed by the intervention and control groups. Figure 8-10 shows the average weekly occasions of home programme and general exercise performed by the intervention group. Table 8-15 details the weekly occasions of home exercise and general exercise.

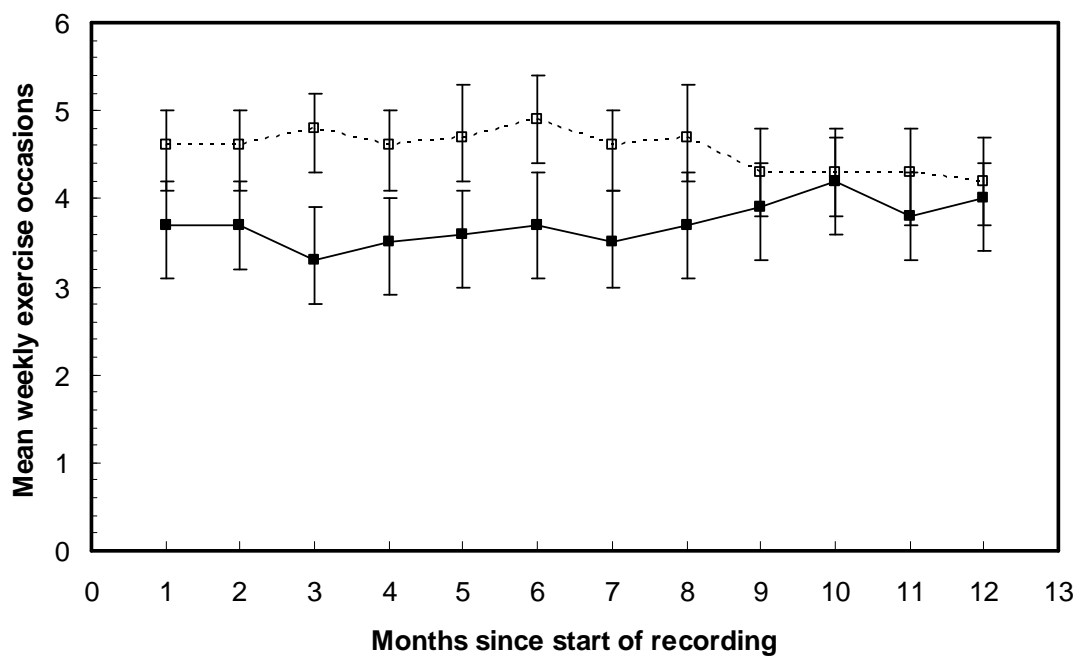


Figure 8-9: Mean weekly occasions of general exercise for control (□) and intervention (■) groups (error bars represent 95% CI)

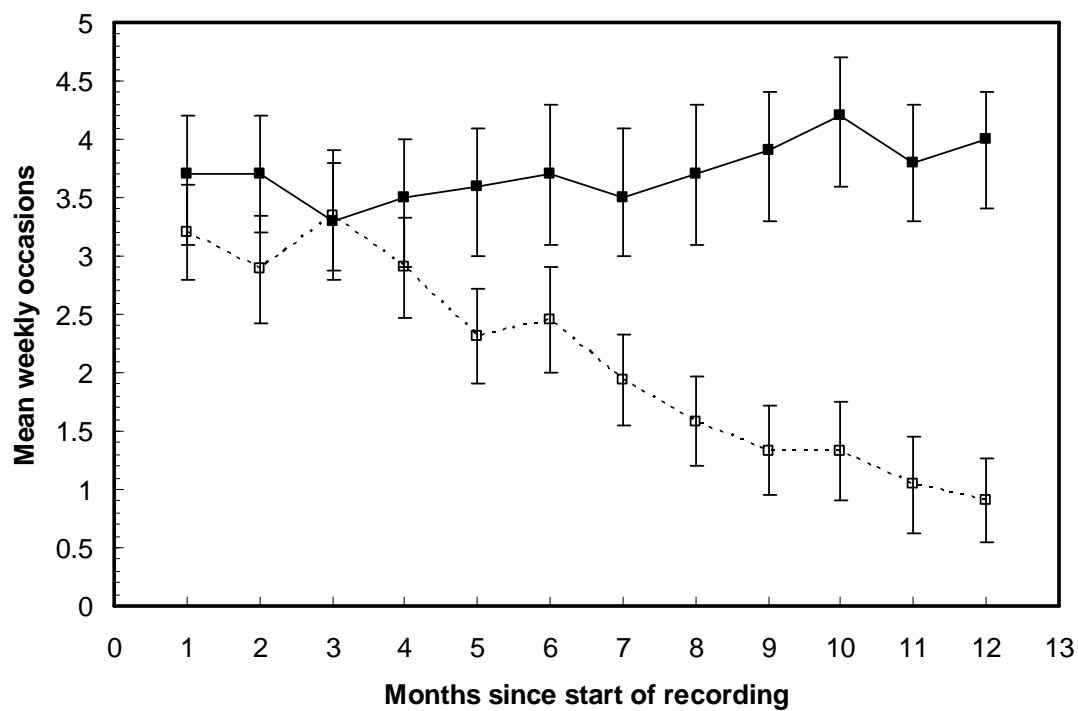


Figure 8-10: Weekly occasions of general exercise (■) and home programme (□) for the intervention group (mean, error bars represent 95% CI)

Table 8-15: Weekly occasions of home exercise (HP) and general exercise

	Median	Inter-quartile range	Minimum	Maximum
Weekly occasions of HP (n=68)	1.8	1.5	0	6.5
Weekly occasions of general exercise (intervention) (n=68)	3.4	3.3	0.7	6.7
Weekly occasions of general exercise (control) (n=70)	4.7	2.2	0.9	7

The mixed model effects tested were group, month and group by month interaction. Only the group effect was significant ($F(1,194)=12.8, p=.0004$,) whereas the month effect and interaction between-group and month were not significant ($F(11,707)=1.11, p=.35$ and $F(11,707)=1.51, p=.12$ respectively).

As the time effect was not significant and the interaction of group with time was not significant it is likely the general pattern for exercise over the year for both groups was constant. That is, they did not increase or decrease over time and the average level for the control group was higher than for the intervention group by 0.34 (weekly exercise occasions) (95% CI =0.38, 1.32).

Overall there were no significant between-group differences for the physical activity questionnaire (Lord et al 1993), with the exception of frequency of the home exercise programme (Appendix H.2). This increase in occasions of home exercise programme was anticipated as the intervention group had been asked to exercise at home on three occasions per week.

8.4.5 Falls

The number of falls experienced by participants in each group during the 12 month follow-up period is shown in Table 8-16 and the monthly fall rate by group is shown in Figure 8-11. The statistical analysis comparing falls between-groups was conducted using the proportion of fallers and the average rate of falls. The presence of a differential effect of the intervention in people with previous falls was assessed using interaction terms in the models.

There was a between-group difference in the proportion of people who had one or more falls in the follow-up period, but this was not statistically significant (odds ratio from logistic regression model 0.53, 95% CI 0.27 to 1.03, $z = -1.87, p = 0.061$). No interaction effect between previous

falls and group allocation was found (i.e., there was no difference in the effect of the intervention in those with and without previous falls).

The between-group difference in the number of falls per person over the 12 month follow-up period (i.e., rate of falls per person) was also examined using negative binomial regression models in Stata. There was an indication of a lower rate of falls in the intervention group but this was far from statistically significant (IRR 0.92, 95% CI 0.51 to 1.63, $z=-0.30$, $p=0.767$).

Two individuals in the exercise group had multiple falls (8 and 13). In case these individuals were unduly influencing the results exploratory analyses were undertaken with censoring of an individual's number of falls at 6. This resulted in a greater effect of exercise (IRR 0.80, 95% CI 0.46 to 1.4, $z = -0.78$, $p = 0.437$). Again, no interaction effect between previous falls and group allocation was found (i.e., there was no difference in the effect of the intervention in those with and without previous falls).

Table 8-16: Number of falls by group

Number of falls	Control group (n=72)	Intervention group (n= 74)
0	37 (51%)	49 (66%)
1	16 (22%)	10 (14%)
2	9 (13%)	3 (4%)
3	3 (4%)	5 (7%)
4	2 (3%)	5 (7%)
5	2 (3%)	0 (0%)
6	1 (1%)	0 (0%)
8	0 (0%)	1 (1%)
13	0 (0%)	1 (1%)

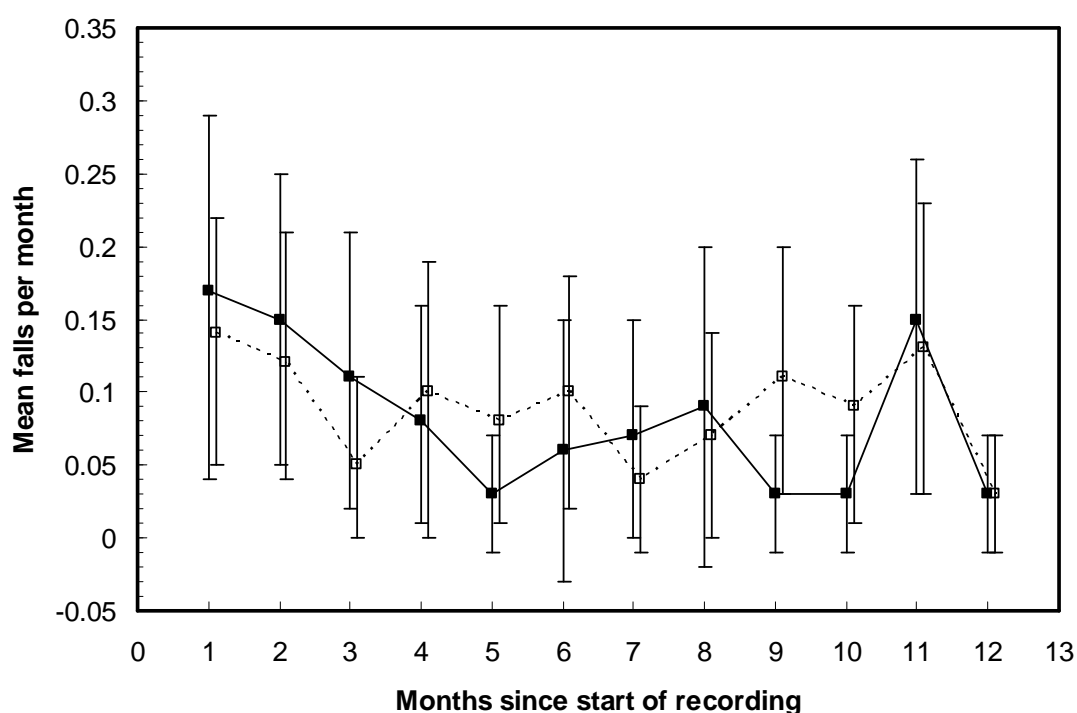


Figure 8-11: Mean falls per month for control (□) and intervention groups (■) (error bars represent 95% CI)

8.5 Adverse events

Adverse events were defined as any injury or symptom resulting from the trial which restricted physical activity or ADL for 48 hours or longer, or which required medical attention/treatment. Physiotherapists were requested to ask participants about injuries at the exercise classes. Participants were also requested to advise the physiotherapist of any injuries. No new injuries were identified specifically related to the programme. However, there were several reports of exacerbations of pre-existing arthritic and musculoskeletal conditions (most commonly lower back and knee soreness). While these were not systematically documented, they were noted by the physiotherapist and subsequent adjustments made to the individual's exercise programme. Through the course of the RCT, there were no adverse events of significant magnitude to warrant documentation using the HNEAHS incident reporting system or requiring medical intervention. None of the participations who experienced falls during the one year follow-up period reported falling while performing the exercises.

8.6 Comparison between study sites

Table 8-17 shows the baseline characteristics of participants in the different towns. No marked differences were seen although there was a higher average fall rate in the year prior to the study at Inverell. There was no difference in the mean number of co-morbidities by site ($p=0.728$). Pre-and post intervention scores for the primary outcome variables (total PPA score and total Berg Balance Score) in the different towns are shown for each group in Table 8-18. There was no significant differences between final performances on the primary outcome measures for people in different towns (assessed using a dummy coded variable within regression models testing effects of group allocation on final performance in Stata).

The intervention did not have different effects in different towns. This was determined by assessing the effect on the model of including interaction terms (variables indicating the interaction between-group and dummy coded town) in the regression models.

Table 8-17: Demographic characteristics by study site

	Bingara (n=16)	Inverell (n=32)	Muswellbrook (n=15)	Quirindi (n=35)	Tamworth (n=49)
Gender M:F	5:11	10:22	1:14	3:32	7:42
Age (yr) (mean (SD))	77.7 (8.9)	78.2 (6.3)	72.9 (5.6)	76.3 (7.1)	76.7 (6.5)
Height (cm) (mean (SD))	160.6 (9.4)	162.1 (9.6)	160.0 (5.3)	161.5 (7.2)	162.6 (9.0)
Weight (kg) (mean (SD))	73.3 (21.9)	74.9 (17.8)	75.1 (14.4)	74.3 (20.6)	71.8 (13.8)
Number of medications (mean (SD))	6.4 (5.2)	5.5 (3.6)	4.6 (4.1)	4.7 (3.4)	4.5 (3.5)
4 or more medications (number (%))	11 (69%)	22 (69%)	7 (47%)	21 (62%)	29 (59%)
Number of co-morbidities (number (%))	13 (81%)	27 (84%)	11 (73%)	27 (77%)	37 (76%)
4 or more co-morbidities (number (%))	13 (81%)	27 (84%)	11 (73%)	27 (77%)	37 (76%)
Falls/past year (mean (SD))	0.9 (1.2)	2.0 (3.4)	0.9 (1.3)	1.1 (2.7)	0.9 (1.1)
SPMSQ (adjusted errors) (median (IQR))	.00(0)	.00(1)	.00(1)	.00(1)	.00(1)

SPMSQ-Short Portable Mental Status Questionnaire

Table 8-18: Primary outcome measures by study site

	Bingara		Inverell		Muswellbrook		Quirindi		Tamworth	
	Control (n=9)	Intervention (n=7)	Control (n=16)	Intervention (n=16)	Control (n=7)	Intervention (n=8)	Control (n=17)	Intervention (n=18)	Control (n=24)	Intervention (n=25)
Berg Balance Scale total ^a Mean (SD)										
Initial	49.2(3.8)	46.7 (5.9)	52.8(3.2)	48.3(8.5)	54.6(1.1)	54.4(1.6)	51.6(5.2)	50.0(6.9)	51.5(6.2)	52.9(3.6)
Follow-up	50.5(4.8)	52.8(3.1)	54.6(1.8)	50.1(8.2)	54.2(1.5)	55.1(0.6)	53.5(5.5)	52.9(3.6)	52.0(6.0)	54.4(2.0)
Falls risk score Mean (SD)										
Initial	2.30(1.18)	3.57(1.62)	1.30(1.35)	1.62(1.21)	0.01(0.59)	0.86(1.17)	1.82(2.21)	1.15(1.37)	0.84(0.88)	0.66(1.00)
Follow-up	1.40(1.32)	1.02(0.72)	0.96(1.69)	0.91(1.48)	0.50(1.12)	-0.03(0.76)	1.19(1.46)	0.56(0.89)	0.95(1.16)	0.54(0.98)

^a Skewed distribution

8.7 Summary of the findings

The average age of participants was 77 years. Approximately two-thirds of the participants lived alone, most independently within the community. The majority of participants suffered multiple co-morbidities and 50% had experienced at least one fall in the year preceding the study.

Table 8-19 summarises the between-group differences from baseline to the 14-week follow-up. The Table illustrates that the intervention had a significant effect on fall risk factors.

Furthermore, there does seem to have been some effect on the proportion of people falling but this was not statistically significant. There was a small effect on number of falls due in part to several multiple fallers in the intervention group. On average, the home programme compliance was stable for the first four months then began to drop-off from the fifth month and continued to decline steadily. In terms of general exercise, analysis suggests there might have been differences over time for the control group, reducing in the last four months, and for the intervention group, increasing for the last four months. However, the evidence for this was not sufficiently strong to draw firm conclusions.

Table 8-19: Summary of 14 week findings

Significant ($p < 0.05$) improvements in intervention compared with control group

PPA composite score

Average knee extensor strength

Hand reaction time

Sway on foam with eyes closed

Berg Balance Scale total score

Choice Stepping Reaction Time

Timed stand on one foot

PPA-Physiological Profile Assessment

CHAPTER 9: FINDINGS OF THE EMBEDDED QUALITATIVE STUDY

Chapter 7 detailed the interview processes and the modified grounded theory method that was used in the embedded study. The resultant qualitative data provided insights into participant, volunteer assistant and physiotherapist views on the programme and its impact on their everyday lives. Three key concepts were identified. This chapter presents these concepts, their respective themes and sub-themes. Illustrative quotes are provided for the sub-themes. Each quote is identified by the speaker's role and number, for instance; intervention participant one is IP1, volunteer assistant one is VA1, and physiotherapist one is PT1. The three parties are collectively referred to as respondents. Quotes taken from the member check interviews are differentiated by the label MC.

As is usual in qualitative research, study findings are considered in the light of the published literature. Hence references are inter-woven throughout the chapter. Because of the differences in the nature of the parts, the themes and sub-themes are presented slightly differently. For the first key concept, the themes are presented as 'attributes' and the sub-themes as 'components'. However, the other two key concepts are presented as 'themes' and 'sub-themes'. To conclude, a summative view of the qualitative research is presented in a starting grounded theory. This final figure pulls together the strands of the qualitative research and shows the relationships between all the different parts.

9.1 Key concept: Confidence and motivation

One of the most important findings related to increased confidence in, and motivation for performing/delivering the programme. This section discusses the programme attributes (themes) and components (sub-themes) which contributed to developing 'confidence and motivation' (Figure 9-1). Each of these parts are considered and described separately.

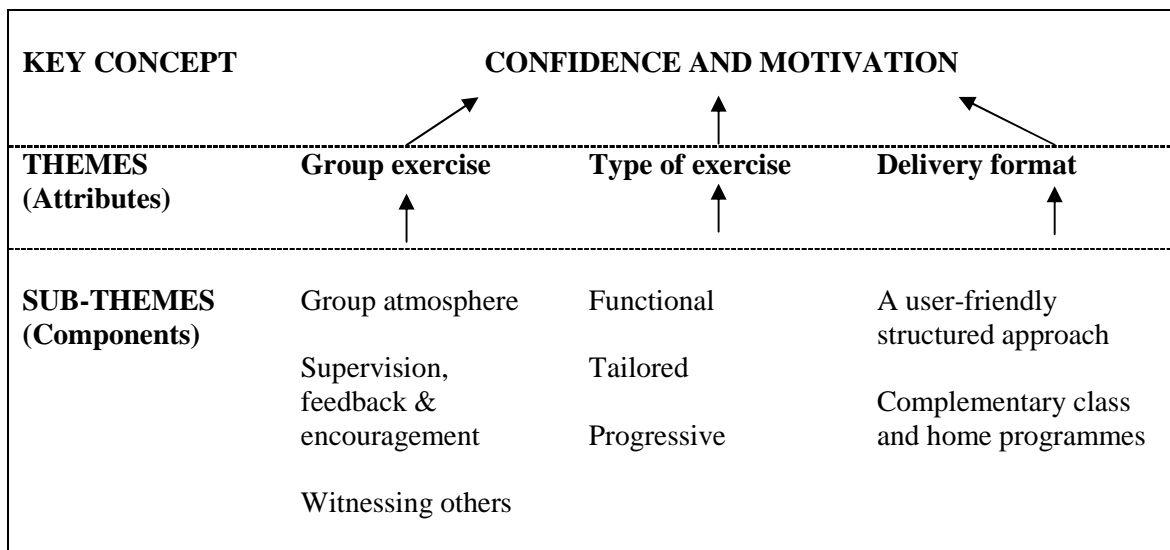


Figure 9-1: Concept - Confidence and motivation

9.1.1 Theme one: Group exercise

Analysis and interpretation revealed that three main components of ‘group exercise’ had built confidence and motivation. They were identified as; 1) the group atmosphere, 2) supervision, feedback and encouragement, and 3) opportunity to witness others. The following quote by a volunteer assistant affirms the benefit of group exercise:

If it was a one-on-one thing, I don’t think they would have gotten as much out of it, as they did in the group situation. I think that was a big factor (VA1).

Sub-theme one: The group atmosphere

Respondents unanimously agreed that it had been enjoyable to come together as a group. The data were replete with references to talking, laughing and having fun. Moreover the quantitative findings showed that in response to the statement, ‘Overall I found the exercise programme enjoyable’, 52 (74%) participants strongly agreed, and 18 (26%) agreed. No participant disagreed, strongly disagreed or was unsure.

Respondents identified that participants, although drawn from a diverse range of backgrounds, were in a similar situation in terms of age, co-morbidities and their shared focus on the exercise programme. Their comments suggest that this common ground promoted a ‘friendly’, ‘empathetic’, and ‘safe’ group atmosphere. This, in turn, boosted participant confidence in performing the programme and motivation for continuing. A selection of participant comments appears below:

All the people in the group had something wrong and could empathise (IP27).

It was a stimulating group, positive and friendly. There were no barriers to the people (IP35).

Talking about the environment another said:

It is nice to be in an environment where I felt safe. Often when I am in a group they don't understand and just gloss over my problems. We were all in the same boat (IP27).

A volunteer assistant provided the following insights:

They were a group of quite disparate people from all walks of life but they became very cohesive. It is that shared task of exercise, they were all there to participate (VA12).

The group interaction also made the exercises more appealing and less of a chore. One participant recounted:

It was fun, the people would laugh. You are doing the exercises but you are not so intent on doing it. It is lighter, the time goes faster (IP133).

Another participant explained:

The cup of tea after the show, it was a social event as well as a work event or a practical event, I felt (IP37).

The exercise programme required participants to perform activities which challenged their balance. Working within a group in a friendly, 'safe' atmosphere helped participants to move out of their 'comfort zone' and undertake potentially daunting activities. As one participant explained:

That's always if you can get together, have a bit of a talk and a laugh, and in an informal meeting, and working together, with the ability to have a laugh, to laugh at yourself, to have a bit of a laugh with someone else. I think that's more friendly and more supportive of one another. Now, I saw that as an important part and I think your inclusion of that couple of breaks and sit around and chat, and cup of tea after, always helps the situation that could perhaps be daunting (IP141).

A physiotherapist concurred:

You might have a joke or something and it's so that everyone feels comfortable. It probably increases their compliance and I think it makes them feel safer. Especially

with a group like this, I think it's fair to say there's a bit of fear about. [They were thinking] I don't really want to stand with my feet close together because I feel less balance and so you're asking me to do this. But they felt secure and they felt happy, and they would try things. From that point of view I think having a nice friendly atmosphere and everybody encouraged to know everyone else's name and ask about what they've been doing, you break down the barriers and make everyone friends, you facilitate by doing that, and then I think you'll get a better result with people (PT3).

A noteworthy finding was the extent to which participants valued and reported to have benefited from the group interaction. Many participants freely acknowledged that they got as much or more from the 'social part' of the programme as from the exercises. Several participants confided that they simply would not have continued to attend, had it not been for the social aspect. One participant explained:

It is beaut to meet in a group and do things. I think it is almost as good as the exercises. You go back because it is a fun group to be in (IP66).

The physiotherapist agreed:

Oh, I think if you don't keep it light and keep it fun and encourage that social interaction, I don't think people would have turned up. I'm certain of it. They really wouldn't have turned up (PT1).

Participants' comments highlighted the important contribution volunteer assistants had made to the classes. Quantitative results supported these qualitative findings. In response to the statement, 'I liked having the volunteers assist with the classes', 59 (84.3%) strongly agreed, 10 (14.3%) agreed, 1 (1.4%) strongly disagreed, and 0 (0%) disagreed or were unsure. One of the major benefits of involving volunteer assistants was their contribution to promoting a comfortable, enjoyable working environment and positive group dynamic. One participant explained:

They were always joking and made you feel at home. At first anything new is different, but quickly you felt at ease. The volunteers helped with this (IP62).

Participants perceived that the physiotherapist played an 'official role', whereas volunteers were on a more equal level. Participants appreciated that the volunteers 'took time to be with them'. This combination of being on a level footing and spending time with participants facilitated the volunteers' contribution to the programme. One participant reflected:

They bring a brightness. They're not professional people, so they are sort of on the same level and you can do the exercises with them and have fun. They are having fun too, so you have fun with them (IP117).

This view was confirmed by another participant:

The atmosphere there was good and supported wonderfully with the volunteers. I felt that was excellent. They were sort of the middle men, they were the people who were interacting, who were assisting and, well, made it more of an integral family almost (P141).

Sub-theme two: Supervision, feedback and encouragement

The class was a forum in which participants received supervision, feedback and encouragement. As described in the following interview excerpt, 'group exercise' provided access to feedback from various sources:

I think as a group that everybody was in the same situation and like there was help and encouragement from the physios, the volunteers and the participants, they were all, everybody was sort of helpful and encouraging to each other and I think that sort of made for a good outcome (VA5).

The majority of participants experienced multiple co-morbidities, and the balance-training programme was, by design, physically challenging. As participant 35 pointed out, encouragement was likely to have been especially important under those circumstances:

Well, I think everyone needs encouragement and support, particularly if you're having injuries at the time and you're struggling with coping physically, then being encouraged with the exercise you're doing is always helpful (IP35).

A physiotherapist emphasised the importance of reassurance and encouragement:

...just to make sure that everyone was ready and 'are you ok?', and reassured and spoken to With the volunteers they just said 'how are you going? You're going well'. That reinforcement made sure every person in the group felt special and felt like they were doing a good job. That was great (PT1).

The classes were also an opportunity to gain specific feedback on performance. One participant explained:

I think feedback is very important. It gives you confidence. You realise there is an improvement but you don't realise how much you are improving. With the classes we got feedback from [physiotherapist's name] as to how we were going with our home programme, how we were improving. If we were just doing it at home we

would not realise how much better we were getting. [*physiotherapist's name*] could see it (IP99).

Participants were reassured to know they were performing the exercise correctly, in a manner likely to maximise the benefit of their efforts, and that help was at hand should they need it.

Respondents explained:

I was being supervised with the exercises, which was helping me. To know this is what you have to do and how to do it. To be sure you are doing the right thing and correctly. It was helpful to be able to ask, 'Is this what I am supposed to do'? Some of it was right and some of it wasn't (IP90).

By assisting, reminding and assisting, our most important role was giving feedback, because I think that is really important and builds confidence (VA12).

The following comments echo the importance of supervision for building confidence:

It gave you more confidence that if you needed help there was someone there keeping an eye on you, anticipating very often before anything happened (IP44).

She [the volunteer] was there to help, she stayed with me and you had someone there if anything happened. She gave me confidence (IP43).

We provided a safe zone for them. Having a 'hands on role' by being there with them, gave them more confidence to take the extra step (VA11).

As earlier discussed volunteer assistants and physiotherapists performed different but complementary roles. Moreover, the involvement of both physiotherapists and volunteer assistants increased participant access to encouragement, feedback and supervision. One participant recounted:

If you have any basic questions you could ask the volunteers and not worry the physiotherapist. They knew. So if you did have a query, they had the knowledge for that particular exercise. Not the expertise of a physiotherapist, but the information of what was required (IP35).

Respondent comments indicated the volunteers 'took a load off' the physiotherapist, providing the therapist with extra time and freedom to focus on individual participants. This made it easier for physiotherapists to deliver the programme. It also increased the quantity and quality of instructions given. One participant explained it thus:

The physiotherapist's attention, she was very attentive and if we did something wrong she was right there to tell us and to make changes. She was one-on-one a lot

with us all. Sometimes we would slip and do something a little bit wrong and she would be there to right it (IP145).

Talking about the volunteers, a physiotherapist agreed:

...making it easier for me to focus on people, you could actually look at what someone was doing and you could take the time to think about how you could make it harder. But if you hadn't had the volunteers, I don't think you would have been able to focus on one person as much. You could do it one by one, you could go through the people, so it did allow you to give more feedback to the people (PT3).

Sub-theme three: Witnessing others

Meeting as a group enabled participants to engage in a comparative process. As illustrated by the comments below, the type of comparison varied, but in most cases comparison had a motivating effect. At the start of the programme, participants used comparison to gauge their abilities and physical status relative to other group members. For example, participants were encouraged to realise they were 'not the only one' with a problem and this seemed empowering to them:

It is the mixing with other people with the same problems. You can see your faults and accept them (IP84).

You realise other people have problems much like your own. Watching the disabilities of other people and how they coped made me realize, I am better off than them and I can do it (IP63).

As the programme continued, participants measured their progress relative to others. In general, comparison motivated them to try harder. One participant explained:

When you are with a group you strive to do the exercises, to keep up with the others. You realise you can do it and you still strive at home (IP8).

This was affirmed by a physiotherapist who said:

That again is where the group setting is better because if they come on a one-to-one basis in the physio. department just for strength and balance exercises, they've got no one else to compare with. Whereas when they're in a group they're looking and thinking, 'I couldn't do this before and I can do it now', or, 'I'm keeping up with that person, that person was a lot better than I am but I'm keeping up with her now' (PT4).

Interestingly, the comparative process appeared beneficial regardless of one's ability level. One of the more able participants made the following observation:

I was setting a bit of a lead for others to sort of follow. I don't mean this in a skiting sort of way, it was just what was happening. That I knew I was a bit above the others, so I was more or less guiding them to something a little bit better I thought, and that served me no end (IP61).

Despite widespread references to comparison and the motivation it generated, there was one exception. Participant 45 reported that although he had been aware of the differences, they had not motivated his performance. His dissenting comment suggested that characteristics of an individual may determine whether the opportunity for motivation through comparison is taken up:

I think it didn't affect me so much in comparing. You appreciated others that are worse off than you, or not as able as you and you accept people who are more able than you and that's perhaps a philosophy of mine (IP45).

One physiotherapist observed that the comparative process assisted some participants to step out of their comfort zone. They would watch others 'take on' a challenging activity which gave them confidence to 'have a go'. In particular, participants were seen to take their cue from more able group members, being inspired to follow their lead and work towards a higher level. The quotation below illustrates this:

But even like I know a couple of my people, if you take away their solid base of support, that was a scary thing in itself. Like, to get them on that wobble mat, but no-one sort of thought that they couldn't actually do it. Other people were standing on it and they were doing OK, and then they thought, well, I'll just go and maybe have a stand on it to see how it goes, whereas they wouldn't have before (PT1).

All the quotes above show how being in a group inspired and motivated the participants and contributed to the success of the programme.

9.1.2 Theme two: The type of exercise

Interpretation revealed three components of the 'type of exercise' that contributed to participant confidence in performing the programme and motivation for continuing. These components were identified as; functional exercise, tailored exercise and progressive exercise (Figure 9-1). The following section discusses each component.

Sub-theme one: Functional exercise

Respondents commented that the style of exercise was relevant because exercises were akin to participants' everyday tasks. As can be seen in the following exemplars, participants perceived

that practicing the exercises might assist them to perform their everyday activities, and this motivated them:

I did exercises where I had to move out of my comfort zone, for example, 'reaching'. So in the supermarket when I am trying to reach, I was doing exercises which would make me stronger and safer, so I could do it without losing my balance. The exercises worked on different areas of the body; stepping, standing, walking and reaching. There were different things and that made it more interesting. They were dove tailed to help me cope with my lifestyle (IP27).

Another commented:

To keep going it has to actually be of some benefit. When you are young you are far more driven to prove yourself, you have that functional push, whether it is exercise or something else. As you get older you are willing to challenge yourself but to a lesser extent. You have to see the point in the challenge (IP66).

The physiotherapists explained and reinforced connections between the exercises and everyday life, which made the exercises more meaningful and motivated participation:

It really, really, put it into perspective. In the class you're saying, well you do, for example the reaching above your head because that's when our balance plays into it, when we're reaching into cupboards and once you said that, they went, 'Oh, I understand why we're doing that', so, yeah, it made it a lot more practical. And they were more than happy and I think that sort of kept them motivated then to keep doing it (PT1).

Several participants reported that through practicing the exercises they learned improved patterns of movement, which enhanced their performance of everyday activities:

There were benefits like even getting out of a chair. I discovered how to do it a better way. Even putting your feet in a better place to start (IP52).

Before the programme I was just walking and hitting the obstacles because I didn't pick up my feet. So now I put it in my mind to look where I am going. When you walk in the programme, you have to pick up your feet. Now I walk and pick up my feet (IP3).

I used to rush a lot. I stop and think now. I still do things in a reasonable quick time but not rushing and getting bruises everywhere up my arms. I am more careful now to what I used to be (IP105).

I used to be all bent over when walking and now I try to pull myself up and try to walk and climb stairs a little straighter and it seems to help (IP50).

A volunteer summed up these functional benefits:

Participants learnt ways to prevent falls, learnt to be aware of obstacles, awareness of their body reaching, moving, placing their feet in a correct way, not to rush, not to go where they knew they were going out of balance, to be aware of limitations in their range of movement (VA10).

Sub-theme two: Tailored exercise

Analysis indicated that tailoring exercises had been a beneficial feature of the programme. Tailoring had made it possible for each participant to perform their own version of an exercise, working to their abilities and at their pace. The following comments indicate that tailoring exercises assisted the programme to strike a balance of being simple enough not to overwhelm, but challenging enough to maintain interest and produce an improvement. The importance of tailoring the exercises was illustrated by the three participant comments below:

Learning to do the exercises was not difficult because they were so simple, but I think they did do things for you (IP112).

Well, they weren't pushing you to your limit but they were expecting effort to be put into them and I think that was good encouragement. I think had they been too exerting or too onerous you may have lost clients over it. But they [the exercises] were encouraging and within the reach, the role of each one there I think (IP65).

It was great to meet people at their own capabilities. No one was asked to 'over-do' it, but the challenge was there all the time for people to do their best (IP119).

The quantitative results supported these qualitative findings. When asked to rate the level of difficulty of the exercises, no participant stated they had been too easy or too hard, whereas, 42 (60%) selected 'about right', 26 (37%) selected 'easy' and 2 (3%) selected 'hard'.

It seems that for some participants, tailoring exercises provided an opportunity for self-competition. Each participant performed their own version of an exercise so they could challenge themselves to achieve and progress. One participant summed this up:

Most of the groups for older people fall down because they push too hard and it just doesn't work. You put the challenge on yourself, to put in as much or as little effort as you like (IP66).

Respondents reported that tailoring exercises provided the additional benefit of allowing persons of varied abilities to work alongside each other. On the one hand, persons of a lesser ability were not left behind as there was always something they could do. On the other hand, more able persons could exercise at a level that challenged them. One participant expressed it this way:

I think there was a great exercising group dynamic there and we all went and we all did similar exercises, or the same exercises to different degrees of our abilities and everyone was doing their thing without, not without regard, but without embarrassment as such (IP52).

As part of the member check (MC) process, a physiotherapist elaborated:

... they would be doing their own thing and each person was able to do that, because the exercises had that really good component of being either able to progress by making them harder by doing this, this and this, or we can make it easier by doing this, this and this. Everyone could do something so there was never anyone who couldn't do a station at all (PT3-MC).

Sub-theme three: Progressive exercise

All parties strongly supported the inclusion of progression within the programme. It was seen as important that participants start with what they could manage, often at a low level, and build on their success, gradually taking on more difficult exercise variations. It seems progressions added interest and demonstrated improvements, thereby facilitating a sense of achievement and motivating performance for the next level of difficulty. One participant described, "... [it] was all positive and encouraging, they had good progression and innovation, that increased the challenge and made it more interesting" (IP61).

Another participant elaborated:

The fact that a new exercise was added each fortnight. The physiotherapist gave us our aim, some I could do and others I had to work up to. You didn't set yourself up to fail but knew what you were aiming for and could just push yourself a little further as time went on. That works for me. I don't like setting myself up to fail (IP66).

The following comment by a physiotherapist highlighted the importance of progression based on realistic challenges:

I think that's the important thing, once they realise that we will only push them as far as we know they can go, that as they're improving we'll challenge them a little bit more but within reason, that they know that we will only make them work as hard as we know they can work and not beyond that (IPT4).

In summary, the components of functional, tailored and progressive exercise enhanced the suitability of the exercises and motivated participation in the programme. This was similar to the findings by Yardley et al. (2006). They undertook a qualitative study to explore the perceived advantages and barriers to taking part in fall related interventions across six European

Countries. Excerpts from their interviews suggest that fall prevention programmes pitched at an inappropriate level adversely impacted participant motivation:

It [the exercise class] was really boring...I felt that I was still too fit to be in that group...I imagined that that kind of stuff was for people in old folks homes (p. 658).

At the course I thought, "Do I really have to go through with this? I can hardly get air and can hardly talk and that wasn't very nice for me because the others are all looking at you...When I looked around and saw those people, it made me feel sicker (p. 658).

9.1.3 Theme three: Delivery format

From a participant perspective, the attribute 'delivery format' referred to the programme's mode of delivery. Analysis revealed two components to the delivery format had contributed to participant confidence in performing the programme and motivation for continuing. These components were identified as a 'user-friendly structured' approach, and 'complementary class and home programmes'. Each component is described below.

Sub-theme one: A user-friendly structured approach

Comments across all parties highlighted the importance of providing a 'user-friendly' programme. This was considered important to enhance participant technique, increase confidence in performing the programme, and provide motivation for continuing. Several elements appeared to enhance user-friendliness.

First, the home programme manual was both easy to follow and helpful. In response to the statement, 'I found the manual helpful', 37 (53%) strongly agreed and 33 (47%) agreed. No participant disagreed or was unsure. When asked to respond to the statement, 'Overall I found the exercise manual easy to follow', 51 (73%) strongly agreed and 19 (27%) agreed. No one disagreed or was unsure. As one participant explained:

Being shown what to do and having it written down, otherwise I would have forgot the things (IP126).

Second, time required to complete the exercises was not overly onerous. This added to the user-friendly nature of the programme. Sixty-seven participants (96%) reported that the time required was 'about right', only three (4%) reported it was 'too little'. No participant reported it was too much or was unsure. As described by one participant:

The home exercises were easy. You always felt afterwards they were good for you and they weren't time consuming, that was the main thing (IP92).

Third, several participants commented that the flexibility offered by the home programme added to the user-friendly nature of the overall programme. They found it convenient that the home programme could be scheduled to fit their routine or it could be broken into pieces and performed among their everyday activities. This finding is consistent with advice to incorporate physical activity into everyday activities (Stead et al., 1997), doing a few exercises here and there throughout the day as it fits with one's usual routine (Clemson et al., 2003). Such flexibility may assist older people attain recommended activity levels. The Canadian Department of Health Physical Activity Health Improvement and Prevention (2004) makes the point that recommended levels of activity can be achieved either by doing all the daily activity in one session, or through several shorter bouts of activity. One participant put it thus:

With the home programme you can fit it in with your housework and what you are doing. The shoulder exercises I do when I am in the chair, the step exercises I do when I come onto the stair (IP109).

Participants found it had been helpful to have a structured programme. The structure promoted a routine which assisted to complete the exercises. The following quotes illustrate the benefits of this structure:

Nice to have something set and definite. You can do a few exercises but if you have something definite you are more likely to do it and get satisfaction from it (IP51).

The discipline of needing to come every week and knowing that you should really try, otherwise I would go backwards (IP44).

These benefits were reiterated by a physiotherapist who said:

The fact they had to come every week motivated them to continue. It broke down some of the barriers to exercises, like temperature and time. It was a more formal approach. They know you're going to ask next week whether you did your exercises... (PT4).

Sub-theme two: Complementary class and home programmes

Comments indicated that the class and home programmes each made different but valuable contributions and ultimately complemented each other. The quantitative findings showed that 40 (57%) participants preferred the combination of class and home programme, whereas 26 (37%) preferred the class, 3 (4%) preferred the home programme, and only one (2%) participant did not have a preference.

The classes played an important role in supporting the home programme. Participants could try the exercises in the supervised, supported class environment and gain confidence to continue at home. Classes also provided an opportunity for review and to have questions answered. One physiotherapist recounted:

It was good, it flowed nicely, followed nicely. The home programme was an extension of what they did in class. There was nothing there to scare them. They knew they could do it here so they could do it at home (PT1).

Another physiotherapist commented:

They know that they'll get that support, they know that they can report back to me, 'That exercise made my legs ache' or, 'I found this one difficult' (PT4).

There was generalised agreement that exercising once per week (at the class) would not be sufficient to produce improvements. Respondents viewed the home programme as an effective way to increase practice opportunities:

You didn't have enough time really, with the, like the venue time wasn't nearly enough time to do what you would have to do to get you up a little bit higher a level on that particular skill (IP52).

It was considered of benefit that the home programme placed the onus on participants to take responsibility for exercising. In so doing, the home programme offered participants an opportunity to play an active role in maintaining or improving their health. One physiotherapist expressed it thus:

One of the things that, with the home programme, I think the fact that we emphasised that it needs to be done three times a week, it gives them some ownership of it, that they can decide when to do it. The fact that they have to take some responsibility for the home programme, too, is very important, that puts the ball back in their court (PT4).

Overall, the class and the home programme acted in a cyclical manner to provide momentum for continuing with the exercises. At the class, the group interaction provided motivation to continue the home programme. Having performed the home programme participants were keen to return to the group and do more: "Having the classes you are more enthusiastic to keep that routine going" (IP112).

A volunteer assistant agreed:

...they could do it in their home exercises without having to just wait for every week to come to class. They could do that and then by the time they did get to the class at the end of the week and they'd coped with the home bit, you know they were all enthusiastic (VA7).

One of the physiotherapists elaborated:

...they could come to their class, do their classes and it sort of motivated them for the week to do their home programme, rather than if you've [just] got a home programme where you don't sort of meet regularly, you sort of lose track. But no, you do your weekly one and everyone would talk and chat and keep you motivated for the rest of the week then (PT1).

9.2 Key concept: Enhanced Quality of Life (QOL)

Section 9.1 presented the programme components (sub-themes) and attributes (themes) which contributed to developing 'confidence and motivation'. From this point there is a slight shift in the way the findings are presented. This section describes the programme outcomes (sub-themes) which impacted dimensions of QOL (themes) leading to the key concept 'enhanced quality of life' (Figure 9-2).

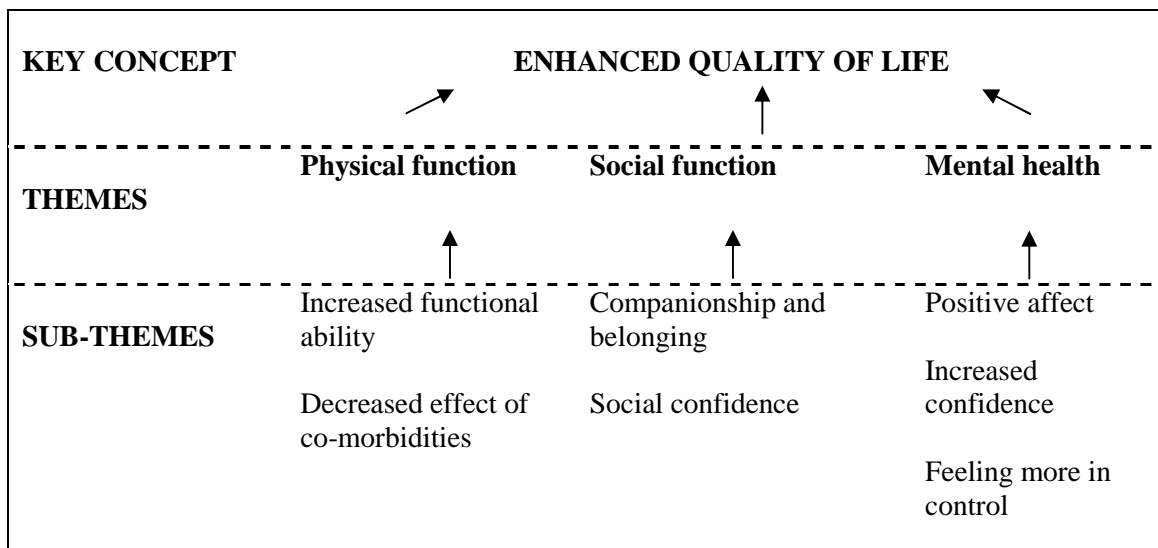


Figure 9-2: Concept - Enhanced Quality of Life

9.2.1 Theme one: Enhanced physical function

Participation in the programme reportedly led to enhanced physical function. Two sub-themes were identified; 'increased functional ability' and 'decreased effect of co-morbidities' (Figure 9-2).

Sub-theme one: Increased functional ability

There was overwhelming agreement that participants benefited physically from undertaking the programme. As one volunteer put it:

Because you know, it was just so helpful for everybody and as volunteers we could see the difference in the people from, you know, the start to the end. Like it was only basically a short time really but you know the physical improvement was just amazing really, wasn't it? With everybody, even people that had the physical constraints, everybody sort of made progress, I felt anyway (VA15).

Respondent comments referred to improvements across a range of physical parameters (e.g. balance, strength and coordination). The most commonly mentioned physical improvement was increased balance. These qualitative findings were supported by participant responses to the question, 'As a result of doing this programme I feel my balance has improved'; 60 (86%) agreed, 1 (1%) disagreed and 9 (13%) were unsure. The following comments by these participants describe improved balance and performance on a range of functional tasks:

I improved balance, I can close my eyes in the shower and I'm not waving all over the place. I can put pants on without hanging on to a door handle or sitting on the bed. Once I had to hang on all the time to do it. My coordination is better. I can lift my feet a lot higher so I am not stumbling. I was always catching my feet on doorsteps. Walking around the house, the right foot would catch on the floor and I would nearly fall over. That was quite a common occurrence. Now I lift my right foot clear off the floor (IP99).

I can reach up in the high cupboards. I am back cleaning my windows and scrubbing my bathroom tiles like I used to do. I can do all the walls. Before I used to be a bit nervous of it, but now I just do it like there is nothing wrong with me. I look forward to doing it (IP105).

I am more flexible in movement. I can bend more easily which I couldn't do before. I don't have a problem with reaching. With reaching, I used to feel as though there was a string attached to me. When it hurt as I reached, I couldn't go any further. Now I can reach without pain (IP3).

It is recognized that increased ability for performing functional tasks (e.g. sit to stand and reaching) is linked with increased likelihood of performing more discretionary tasks like gardening and doing errands (Stewart & King, 1991). The following participant comments illustrate that the programme enhanced performance on role and recreational activities:

I can get up and down better like picking things up off the floor or when I am in the garden (IP51).

With bowling, my balance has improved. I am able to get down lower and deliver better (IP61).

The exercises have helped me to look after my cerebral palsy granddaughter. I find it easier to look after her because I am not as stiff and not hurting as much. I can get up and down easier with her. Getting up and down from a chair improved, everything improved (IP62).

Physical improvements were also linked with psychological benefits. The quotes below illustrate that improvements which flowed from the programme generated positive affect:

I am very thrilled to think I can get up out of a chair, that's really sparked me. I think if I hadn't done those classes I still wouldn't be getting up properly (IP121).

I am walking better. I am walking without my stick in the house. I am doing things I thought I could not do. That makes you feel better (IP90).

The above quotations showed that the programme positively impacted physiological parameters, improved a range of functional activities and generated psychological benefits.

Sub-theme two: Decreased effect of co-morbidities

As people age, pain increasingly becomes a part of everyday life, due, for example to musculoskeletal problems and arthritis (Stewart & King, 1991). Clinical practice guidelines identify a role for physical activity in the management of pain (AGS Panel on Persistent Pain in Older Persons, 2002; Hagen, Hilde, Jamtvedt, & Winnem, 2002). Moreover, Stewart and King (Stewart & King, 1991) hypothesised that exercise interventions which reduced discomfort, would improve QOL. Many of our participants reported reduced effect of a co-morbidity or co-morbidities. The following selection of comments provides examples of co-morbidities that were positively impacted by the programme:

I can move my joints a lot better, because I've got this osteoarthritis the same as every body else. You have to try to overcome a bit of it. I feel much happier in my mind and self (IP105).

I had pain in my ankles with every step and my knees, now they are not painful, they just work much better (IP133).

I haven't had a backache since I started this programme. Before this I had been taking Panamax every four hours (IP38).

Additional to the improvement in musculoskeletal problems mentioned above, quotations below show the programme impacted a range of health conditions:

I still do the home exercises, it helps with the breathing. I suffer with short breath through the heart problem. It is easier to breathe now. It does not seem to be as much trouble doing everyday tasks (IP11).

It helped me walking uphill, the muscles in my legs, the circulation seems better. I did have a blocked artery in my leg, with the exercises and walking they say the blood is getting through now (IP96).

A couple of years ago I had an inner ear thing. Before I was doing the exercises I used to get a bit giddy if I looked up or got up quickly but I think that has improved. I am putting it down to the exercises, it helped me with the giddiness (IP72).

It helped me overcome the slight stroke I had (IP89).

The above quotations reveal that in this plethora of conditions the symptoms were considerably lessened or even disappeared over the course of the programme. These findings are consistent with clinical practice guidelines which identify a substantial therapeutic role for physical activity in the management of many chronic conditions, for example; stroke (Gordon et al., 2004), peripheral vascular disease (McDermott et al., 2006), chronic obstructive pulmonary disease (Pauwels, Buist, Calverley, Jenkins, & Hurd, 2001), osteoarthritis (American College of Rheumatology, 2000; American Geriatrics Society, 2001) and pain (AGS Panel on Persistent Pain in Older Persons, 2002), including back pain (Hagen et al., 2002). Moreover, these findings confirm that the balance exercises which formed the basis of the present programme and were primarily intended to reduce fall risk, also has a therapeutic effect on a range of chronic conditions.

9.2.2 Theme two: Enhanced social function

Participation in the programme reportedly enhanced social function. Two sub-themes were identified; 'companionship and belonging', and 'social confidence' (Figure 9-2).

It is noted that the subtleties of the researcher's interpretation have separated things which may seem similar but are in fact different. Section 9.1.1 identified 'Group exercise' as a theme of the key concept 'confidence and motivation'. This section identifies 'enhanced social function' as a theme of the key concept 'enhanced quality of life'. Whereas the former refers to the social aspect increasing confidence in and motivation for the programme, the latter relates to personal identity.

Sub-theme one: Companionship and belonging

According to Levett-Jones, Lathlean, McMillan and Higgins (2007) human beings are fundamentally motivated by the need to belong. Yet social isolation is one of the most pervasive conditions of old age (McMurray, 2003). The following comments illustrate participants' desire for social interaction:

I am home on my own and even though I never thought it would worry me, it does after a while (IP76).

The social side, I hadn't been in groups for a long time. I felt I need to be in a group. I haven't worked for about eleven years and I don't mind mixing with people (IP127).

One volunteer assistant noted:

A few of the clients have said the social aspect was just as important as the physical. A lot of these people tended to stay at home and not get out and mix because of their disabilities (VA4).

The exercise classes were an opportunity to meet with others and form relationships. As one participant explained; "But you know they were able to, sort of, have a good old chat together sort, of thing, and find out each others' likes and dislikes, and so forth and they were helpful towards each other and enjoyed each others' company" (IP52).

As described above, facilitators and peers took an interest in each other and were caring and supportive of each other. Moreover, they shared their broader life stories and experiences. These processes reflected a depth of interaction and relationship suggestive of 'belongingness'. Sommers (1999) defined belongingness as "...the need to be and perception of being involved with others at differing interpersonal levels...which contributes to one's sense of connectedness (being part of, feeling accepted, and fitting in), and esteem (being cared about, valued and respected by others)"(p. 16).

The following comments illustrate a sense of connectedness and belonging within the group. Some quotations came from the direct study and others were additional, coming from the member check process (MC). A physiotherapist observed: "Right from the start they developed a mateship. They were concerned when Jenny was ill and welcomed her back, that was nice" (PT4-MC). Of particular interest, were insights into why companionship had been important. One participant expressed it as: "The companionship was great. You don't feel so isolated and alone" (IP63).

Another participant elaborated:

The social aspect, opportunity for tea and coffee and a chat afterwards, you go away feeling you got close to people. Otherwise it leaves you cut off. Without that you feel isolated from other people. Because I live on my own, I am conscious that I need to be able to talk with people my own age. The tea and coffee was an opportunity to share with others (IP135).

The following volunteer comment suggested that the group atmosphere may have been an important factor in promoting bonds:

It's, I think it's an acceptance of people, where they're at. No matter what level of fitness they're at, there was something there for them, you know, in their exercise. And they were able to share with other people there some other aspect of their outside life. I think that formed a bond within the group. It is an open, safe place where they weren't going to be criticised, so as I said, accepted for who they were at that time (VA10-MC).

Several respondents identified that the group provided a forum for participants to discuss their situation or problems, thereby offering support and reducing their sense of isolation. It is recognised by several authors that relationships with others are a powerful contributor to both physical and psychosocial wellbeing (Bowling, 1994; Bowling et al., 2003; Bowling & Grundy, 1998; Johansson, 2003). In particular, there are long established associations between social participation and support, feelings of security, self-esteem and control over life (Wenger, 1992; Wentowski, 1981). The following comments illustrate that within the relationships of peers and facilitators, support was both given and received. Two participants said:

I enjoyed the group session. We became friends and encouraged one another. If you had a problem, we swapped helpful hints. I live in a situation with normal people and I just have to cope with what I am doing and there is no one to help me if I can't (IP27).

You are trying to improve yourself and support other people who are there (IP133).

These feelings were reiterated by one of the physiotherapists who commented:

It was the caring aspect, volunteers and other members asked about them, how they'd been during the week and did they finish their programme, all that sort of thing (P51).

Similarly, the volunteer assistants explained that it was important:

To support and encourage them. Someone to listen to their stories and tell a few stories too (VA9).

Another elaborated:

There was a great benefit for those who came here and took part in the class as they got mutual support. A trouble shared is a trouble halved. Naturally they talked about things they were facing and I think that was of benefit to them. A lot of these people were socially isolated, they could compare notes, see how they were getting on, what they could do to help themselves and each other (VA14).

A Report by the World Health Organisation [WHO] (1998) makes the point that both independence and interdependence are important goals of ageing well. Moreover Johansson (2003) suggests that reciprocity, both being cared for and caring for others, can be an important component of a meaningful life. Several of the above comments suggested that the classes provided an opportunity for both interdependence and reciprocity.

Interestingly, some participants made the point that although they did not consider themselves to be a 'social person', they had enjoyed participating in the classes. For persons wary of group activities, it seems participation was facilitated by meeting in a small group, with persons with similar characteristics and a common focus. One participant said: "I am not a great social person but it was nice to get together with people" (IP65). A second elaborated: "I'm a quiet person and not a good mixer. I found coming here, with other people of the same age and doing the same thing, I interacted better, I really enjoyed the company" (IP101). Whereas another participant said: "I don't like being in big crowds and a lot of noise but being able to talk with a few people and have something in common like exercises. I enjoyed that" (IP52).

Sub-theme two: Social confidence

A number of respondents observed that several participants had gained social confidence through attending the classes. Participants were observed to 'come out of their shell'. In a broader sense, attending the classes provided an opportunity to take part in society. One participant expressed it this way:

I came out of my shell a little bit to be able to interact with others more. You can always have a laugh over something, it takes me back to when I did used to like a lot of company (IP54).

The volunteers observed:

The improvement in their physical ability and also their social skills, because some people were sort of, very inhibited and very shy, but after a few weeks they were in there mixing in with the others. So I thought that was really good in bringing people out, not only physically but socially (VA7).

Well the lack of confidence you can gather from taking part in social outings and social gatherings and so forth....improved social outlet, so instead of, sort of, being locked away as so many of the elderly people are on their own, a lot of them do tend to retreat into their shell a bit, but they come out and become far more active and simply getting outthey felt that they are actually taking part in society instead of being locked away from it (VA16-MC).

Earlier the point was made that exercising in a group led to companionship and ‘belongingness’. The above comments elaborated on these ideas and showed that for some participants, being in the group also boosted their wider social confidence, creating an apparent positive impact on the social domain of their quality of life.

9.2.3 Theme three: Enhanced mental health

Participation in the programme appeared to enhance mental health. Three sub-themes were identified; ‘positive affect’, ‘increased confidence’, and ‘feeling more in control’ (Figure 9-2). These are elaborated on below.

Sub-theme one: Positive affect

Respondents overwhelmingly agreed that participants enjoyed being part of the group: Participant 18 said: “We enjoyed one another”. A volunteer assistant remarked: “[*They would*] smile, talk and laugh. They all had fun” (VA1). This was verified by another of the volunteers who commented: “They all went home happy. I don’t think anyone went home with a sad face” (VA9).

Many short comments referred either directly or indirectly to the positive affect generated through participation in the programme. Participant 12 said: “It was a pleasure being together as a group”. Another elaborated: “I enjoyed a bit of a chat, it gives me motivation” (IP82). Participant 54 observed: “They try to make it as much fun as possible, so it does both things. It is amazing how much benefit you can feel if you have a laugh” (IP54). This was verified by a volunteer assistant who said; “They would have a laugh or a joke and that was good for them mentally” (VA10).

Sub-theme two: Increased confidence

Proposed psychological mechanisms related to mental health outcomes of physical activity include; improvement in perceptions of competence and confidence about the body and its capabilities and experiencing a sense of achievement, mastery and self-determination (Department of Health Physical Activity Health Improvement and Prevention, 2004). A

volunteer assistant provided the following insight into the association between one's physical state and level of confidence:

...it starts in the physical side and if the confidence in the physical side is not there, well then, everything else falls in a heap (VA16).

Comments from a number of respondents showed this generalised effect and indicated that participants became more confident in their movement. Respondents often spoke of increased ability and confidence in performing a task. One participant said:

I can balance myself a lot better, I went to my grandson's wedding in Sydney a few weeks ago and I was up dancing, I could not do that before, I think it is from this [*exercise programme*]. I hadn't danced for years. I wasn't frightened to get up on the floor like I used to be (IP105).

No cars were coming. I stepped out. A car flew up! I stepped back and I was more balanced than I have ever been. I feel I have more confidence. The muscles in my legs are stronger. It has helped me, I might have gone over but I didn't (IP115).

I used to worry about my walking and getting up the steps. I have more confidence in myself and in my walking and climbing stairs (IP50).

Volunteer 11 concurred with these generalized feelings of confidence in everyday life:

It was a confidence builder for them. You could see how much they were improving. By the body language and the way they did the exercises and progressed (VA11).

Several participants reported to be, or were observed to be, more confident in their general abilities and in themselves:

I have more confidence, I was getting to the stage where I was apprehensive of moving about the house, because I so often stumbled I was worried about making a cup of tea and carrying a tray. There is no question I feel more confident getting about the house and garden. I just move around the house without thinking that I will stumble or fall (IP99).

A volunteer observed:

Mrs. [name], the heel raises, she was so timid when she started and by the end we were making comments like, she was going to be a ballerina. For someone who was as sick as her, that was great. It seemed to change her whole outlook, she became more confident in her being. It was just something that kicked in because of the exercises, like a second nature sort of thing (VA13).

A physiotherapist elaborated:

...just to boost their confidence again. To let them know that they don't have to base their life on fear of falling.....To let them understand that not all is lost, that their ability to do things is still there. It's just giving them the confidence to be able to do it... (PT4-MC).

Li et al. (2003) argue that declines in health status, functional ability and QOL could affect older adults' sense of their own abilities. Consistent with Bandura's Social Cognitive Theory (1986; 1995), the following three comments illustrate that mastery of everyday activities led to a sense of achievement and increased self-efficacy:

Taking up the challenge to do something thought not possible. Extending the boundaries helps with confidence and the realisation that you can do things (IP44).

I surprised myself pushing up the wall. I didn't think I could possibly do that, I felt better afterwards and I could not stop myself doing it. I was so pleased with myself. I know I have benefited. When you know you can do something you didn't think you could it gives you a bit of a boost (IP90).

Finally, the third participant said:

I think probably a lot of the people there were at the stage where they weren't confident about doing lots of things, that maybe they were more confident about at the end of the programme and you know they had different, I suppose, limitations on themselves than they would have had, had they not been to the programme (IP119).

A volunteer assistant summed it up in the following way:

It improved their outlook on life. They have skills they thought they'd lost and were surprised they could achieve a lot of these things (VA9).

Several participant comments also suggested that successful performance and increased self-efficacy on functional exercises and ADL, led to an increased satisfaction with life. These findings were consistent with those of the 'Steady-As-You-Go' programme (Cheal & Clemson, 2001). The stories below of participants 143 and 95 illustrate changes in self-efficacy and infer increased life satisfaction:

The bending and reaching, just about everything I could not do before. It took all the stiffness out of me. If it wasn't for my back I feel I would run ten miles. I can get in and out of chairs a lot easier and I was having trouble with my shoulders. I could not reach up. If I wanted to hang clothes on the line I had to keep this hand up and I don't have any of that now. I'd been to the physiotherapist with it. I have

spurs in the shoulders. I reckon I've worked them out. I reckon I'm ninety percent better to what I was, it's nearly gone. All over really. Everything really, bending, standing, moving, reaching, a whole "new me". Just getting things out of the cupboard, I can do it without hanging on now. I can even get out and have a game of cricket with the grandson which I haven't been able to do for a while. I am walking straighter and better. I think when you have back problems you can tend to stoop over. On a car trip I used to have to pull up and have a walk. Often traveling was a problem. Now I can go from [town name] to Brisbane without a problem. My back is seventy percent better than what it was when I started. It is all from the classes. My granddaughters used to say, 'Nanny come on out and throw the ball', which I couldn't. So they are very happy now they have a Nanny who can move around. My son and daughter-in-law want to take me over to America next year, I think before I would not have been able to sit for long enough, I think I could probably make the trip now. I am sleeping better. Before I started, I wasn't sleeping well at all. Now I have hardly any problems and I put it all down to the exercises, I have a lot to be thankful for (IP143).

The ideas above are expressed in another way by a participant who said:

I can do things now I haven't been able to do for years. I can do housework, gardening. I can do anything I have to do. Pull big heavy hoses around the garden to pump from the creek and bore. I can walk down to the creek, feed the geese. I am almost back to normal. I feel good, wonderful. I've got my confidence back and this has made me a lot happier than before, more content than I have been in years. I look at life differently now, everything is good again (IP95).

Respondent comments indicated that participating in the programme had a flow on effect to a range of activities. A number of participants reported to have returned to former activities and to have become more active overall:

Before, I never did any craft work. I did six mosaic pots and I feel the exercises helped me to do it. Before, I might have been too lazy to do it (IP81).

This improvement in confidence was noted by a volunteer assistant:

...cause even the people that were living down the road at the retirement village, they were walking backwards and forwards up the hill to the class, you know just to get a bit more exercise to sort of boost it a bit and I don't feel that they would have been doing that otherwise. They wouldn't have been, because at first when it first started they were getting dropped off there by the bus and then after a few weeks they were thinking, 'Oh well I could walk up there, you know, that'd be a really big help for my knee', and like they wouldn't have thought of that otherwise, I don't think. They thought well, I can do these other things now that's also going to help (VA15).

A physiotherapist provided the following insights:

Well, the fact that they can see that the exercises are increasing their strength. That gives them that confidence and that ability to move. You know the fact that they become very....you know? Moving forwards, even to walk backwards is a threat to them, to step sideways is a threat. So when you're doing exercises that incorporate....that they think, 'OK, I can do this'. So they're doing their exercises in a controlled area and then they can transfer them to home. So then hopefully they will do it when they go outside the home and I think it does empower them to go out. To have the confidence to go out and to have a better quality of life because I think that's what happens with a lot of these people that become so reclusive, really, because of lack of confidence and the fact that they don't want to go out because they're going to fall, or they're frightened of falling, or they won't go on a bus because they're frightened of falling. It certainly does make their quality of life less if they can't do those sorts of things. So I think that empowerment to be able to think 'Yes, I've got the confidence I can do it now because I know what I'm about', certainly is a huge plus for the programme (PT4-MC).

In terms of the programme's impact on participant confidence, participants were specifically asked to rate its effect on their fear of falling. In response to the statement 'As a result of doing this programme I feel less frightened of falling', 56 (80%) agreed, 4 (6%) disagreed and 10 (14%) were unsure. Open question responses corroborate that for many participants the programme had positively impacted (to varying degrees) their fear of falls. This was consistent with the findings of Cheal and Clemson (2001). Many participants continued to be mindful of future falls but felt their general safety had improved. The following three quotes illustrate this:

It has helped me to have a different attitude to falling. I think I am a little more positive but I am still looking. I am sort of wary. Perhaps I am a bit more confident than I was but still wary (IP148).

When I had my fall I had no confidence at all. Doing the programme helped build it up. I could do so much more now than I did before. Now I have better ability to save myself if I start to fall, perhaps before it might have been a fall (IP26).

I was never afraid of falls but it made me more sure of myself so you don't think about it (IP117).

Sub-theme three: Feeling more in control

Participants developed an appreciation for the role of exercise in preventing falls, improving function and reducing the impact of co-morbidities. Many came to understand that exercise could be gentle yet still effective. These findings are consistent with a report by WHO (1998) which stated that by exercising, it is possible to induce positive changes which can help to reinforce a person's belief in the value of physical activity for maintaining wellbeing. One participant explained:

The knowledge that the exercises don't have to be really hard. When they showed people exercising on TV, and I think I realised if you can't do that you can do something else. That you don't have to go for hours, a certain number is just as

beneficial for you. You don't have to run it all at once but can do it bit by bit through the day if you want. It taught me that when you are doing house work, for example hanging clothes, that is sort of that exercise, picking the clothes up and putting them on the line. So I try to do it whenever I can and as an exercise (IP133).

With reference to her chronic back pain, another participant acknowledged:

My problem was I was sitting around waiting for it to get better instead of helping it get better (IP143).

Volunteer assistants offered the following insights:

Yeah, because they felt that they had sort of become a bit 'stuck in the mud' sort of thing and just plodding along, living with their disability and not sort of doing anything about it. And I felt that when they came there and thought, 'Oh well', 'wow', you know we can do something about it and that sort of gave them a bit of motivation then to get up and do things (VA15-MC).

It draws their attention to the risks of falling and what they can do about it. Because everything was focused on balance they went out thinking they could do things to keep themselves stable (V5).

Participants, through increasing confidence in their abilities, began to feel more in control of their situation and lives. This finding is consistent with research showing that greater perceived control is associated with more effective coping (Bandura et al., 1977; Bowling et al., 2007; Folkman, Lazarus, Gruen, & DeLongis, 1986) and better QOL (Bowling et al., 2007). In the following excerpt, a participant describes how achieving programme goals boosted her sense of control:

You knew where you were headed and knew what you were trying to do. It makes you feel you are in control and it's good when you get to the goal. You think, 'It does happen, its happened' (IP66).

Another participant described an increased sense of control in relation to her everyday activities:

I feel different, as though I can cope with things more than before I started. I am not frightened to have a shower in the morning. I used to think, what if I fell over or slipped. Nothing like that enters my head now. I feel more strong and confident that is the only way I can put it, I find I can do more things now than I used to (IP105).

A volunteer assistant observed:

Some people, when they first started, were very frail and shaky, they became quite confident in their exercises and movement. This gave them back the control in their life. As you age you have to deal with chronic problems like sight, rheumatism, hearing loss, using a walker, osteoporosis, Alzheimer's, a host of different things. The exercise programme encouraged a positive outlook and well being. It conveyed the message that no matter how much you have in a disability you can still have control and enjoy life (VA13).

Interpretation indicated that a desire to maintain independence had been a big motivator for participation in the programme. Four participants said:

It is preventative and helps me to look after myself in the years to come (IP61).

You know you are helping your body so your body won't deteriorate any more. I have no wish to become helpless (IP109).

One of the reasons I put my name down, I have a sister in a nursing home, she would not exercise and in the end could not do anything. This is something I damn well don't want to happen to me. Most of my family have lived till a good age. I hope I've got a bit longer and I want to make the most of it (IP119).

I knew it was another step towards my ultimate aim of independence (IP26).

A volunteer assistant provided the following explanation:

...the motivation, because if they can feel that they are able to sort of operate on their own, take care of themselves, well then, it's a tremendous boost of confidence and of course motivator for doing the exercises. So as they go through the process, if they can feel that they are improving, they can feel that they're getting some benefit out of it, well then they're far more likely to, in the first place, more likely to practice at home and in the second place more likely to, you know, to want to do a little bit more to make sure that they keep that independence (V16- MC).

A physiotherapist agreed:

...but they knew and they felt like, well, I'm doing everything I can and to get the most out of my old age (PT4-MC).

WHO (1998) makes the point that it is important an individual be instrumental in improving their quality of life. Interview comments indicate that the programme provided participants with a means of accessing expertise and a structure which enabled them to take control, as well as assisting them achieve their goals (e.g. maintaining or improving physical function, confidence and independence). One participant explained:

...because you people started the programme up. We had help when we least expected it. We would not have had these things that were giving us balance, like

reaching exercises that were doing us good. I think it is a wonderful service (IP103).

A physiotherapist explained it thus:

It's definitely raised awareness of one, that they shouldn't be falling, that you can do something about it. So you've got that knowledge of 'This is what I can do about it'. It's giving them something, making them feel as if they're taking some control of their own self-management and I think that's really important. That if they've been frightened of, 'This is how I'm going to be for the rest of my life', and then somebody gives them something that's going to help them so that, it's an awareness of, yes, there is something I can do, but it's also the awareness of what's available, 'What help is out there for me so that I can have a better quality of life' (PT4-MC).

Another physiotherapist provided the following insight:

Well I think that probably comes from the fact that they've seen that they can do something in a small way because it wasn't really that much, they didn't have to do a lot and it did make them, they improved and I think people felt, 'Well I can actually do something and it equates to me then being less at risk of a fall so I feel more in control. Someone hasn't given me a pill and I'm better, I've actually done this myself, like because I do this and this and this.' Do you know what I mean? Like I think maybe it's a sense of, they've taken over the responsibility for themselves a bit and then that makes you feel more in control (PT3-MC).

The above quotations indicate that by partaking in the programme, participants came to physically and mentally realise the benefits of exercise. This provided them with a sense of control over their situation, and positively impacted on their quality of life. These findings are consistent with evidence that regular exercise can improve the concept of personal control and self-efficacy (Mazzeo et al., 1998).

Without exception, participants reported to have benefited from the programme. In response to the question, 'Overall, I found the programme to be': 40 (57%) participants selected 'greatly beneficial'; 23 (33%) selected 'moderately beneficial'; 7 (10%) selected 'a bit beneficial' and no participant selected 'no benefit'. Findings presented in section 9.2 indicated these benefits occurred across three main dimensions of QOL; physical function, social function and mental health.

9.3 Key concept: Factors in programme implementation

When reviewing the data, it became clear to the researcher that there were many considerations, both positive and negative, surrounding the implementation of the programme, as Figure 9-3

below illustrates. Consistent with the literature review presented earlier in this thesis (see section 2.5.5, Chapter 2), the current section presents first the barriers and then facilitators to implementation.

KEY CONCEPT	FACTORS IN PROGRAMME IMPLEMENTATION	
	Barriers to delivery	Facilitators to delivery-format
THEMES		
Sub-themes	Limited time Limited experience/confidence Limited resources Management approval required Limited transport	Packaged programme Coordinator Professional network Minimal equipment Volunteer assistants

Figure 9-3: Concept - Factors in programme implementation

9.3.1 Theme: Barriers to delivery

Several barriers were identified. These appeared to have been directly related to and/or magnified by the rural context. The most commonly mentioned barrier was ‘limited time’ on the part of the physiotherapist to ‘take on’ provision of an additional service. Therapists also referred to their limited experience in delivering fall prevention programmes and felt this impacted on their confidence to provide the service. Physiotherapists made the point that exercise programmes generally require equipment, but they had limited equipment and a tight budget. A further barrier was the need to gain management approval prior to commencing the programme. This was considered a time consuming and somewhat daunting task. One physiotherapist described it in the following way:

Lack of knowledge of what strategies and techniques will be effective. *[I have]* no access to an evidenced based approach to this. *[There is a]* lack of time to organise, for example, advertise, get exercise handouts ready, and so on. Lack of physical support, because I am a sole therapist and there is a high risk of patients falling if there is a lack of supervision and support. So I am probably more likely to do one-

on-one with this type of person. Lack of equipment, step blocks and balance pads were not available prior to the programme (PT3).

Another therapist perceived that:

When time is precious you would rather stick with things you know. You get into a way of working, a comfortable working routine and if you perceive it as something that will increase your workload, you're less likely to try new things... Confidence in my ability to choose specific exercises, ones that would be the most beneficial in reducing falls (PT2).

Limited access to public transport is typical of many rural locations (Wakeman & Humphreys, 2002). In terms of travelling to the classes 52 (74%) participants stated they drove, 7 (10%) travelled by hostel transport, 5 (7%) walked and 6 (9%) were driven by a volunteer assistant. Should these means of transport become unavailable, access to the programme would be compromised. As one participant pointed out:

I felt that some of the people would have had problems had not other people helped them in sort of getting to the venue. That might be something that could be looked at. Some of the people that really need the programme, you'd have to have a way of getting them to the venue in the first place (P61-MC).

A volunteer assistant agreed:

The only downfall is that transport is a barrier to participate in programmes. Many can't drive because they have lost their sight. Their families have to work. They have to rely on some way of getting to a programme such as this. Especially in the country areas, we don't have trains or designated buses that go around. There may be one every four hours, buses don't have hydraulic lifts (VA10).

Older people often report shortage of transport as a barrier to taking part in physical activity programmes (Department of Health Physical Activity Health Improvement and Prevention, 2004). Furthermore, in many rural areas transport is non-existent or limited in terms of type, frequency and coverage (Bourke et al., 2004; Wakeman & Humphreys, 2002). The above quotations confirm that in the present study, lack of available transport was a barrier to accessing class venues.

9.3.2 Theme: Facilitators to programme delivery – delivery format

Section 9.1 discussed barriers to implementation but the study also found a number of features which assisted implementation. 'Sub-themes' were conceptualised as features which facilitated programme delivery. These features increased the ease of delivery and physiotherapist

confidence in delivering the programme. The five main facilitators were identified as; 'packaged programme', 'coordinator', 'professional network', 'minimal equipment' and 'volunteer assistants'. The following sections will elaborate on these.

Sub-theme: Packaged programme

The package (programme and all resources) had been fully developed and was ready for use. This reportedly reduced the organisational burden incurred by physiotherapists, increased the ease with which they could deliver the programme, and enhanced programme quality. One physiotherapist emphasised:

I think having a pre-planned programme is absolutely essential and that's what I liked about the programme, that we knew where we were going with it and so it wasn't a really daunting task to think, 'We've got to do it today and we've got to get this all organised'. Because we were prepared and had the format, we were able to do it more easily (PT4).

Sub-theme: Coordinator

Time pressure and professional isolation are widely recognised features of rural health professional practice (Curran et al., 2006; Schoo et al., 2005; Sheppard, 2005). Physiotherapists' comments highlighted the importance of having the researcher as co-ordinator and implementer of the programme. In particular, they spoke favourably of the researcher's contribution to programme development, delivery and ongoing support. The following exemplars describe the coordinator's role and the significance of that role:

If you're in a rural place and you're the sole therapist, you just haven't got the time to, firstly, recruit the people and then, secondly, if you've got to do handouts and things for a group of people, is a lot of work. And like with the way it was set up, I basically only had to allow an hour and a half each week which made it achievable and I don't think, if I'd had to spend the time getting the people there and then making a programme beforehand, it would have been a lot more hours, and, as well, not knowing. It meant with you doing it, you did the research on what to go in it as well (PT3).

One physiotherapist reflected:

Because you did all the work, I just turned up and ran it. Because it was ready made, hand it to you, just go and do this. It was easy (PT2).

Another physiotherapist summed it up as:

The support was very valuable. I knew if I had any problems that you were there. It is handy to know we had that back up.... and I think probably just knowing I was on the right track (PT4).

Support from management has been identified as one of the key enablers of programme adoption (Lovarini, Clemson, Dean, & Mathews, 2008). Physiotherapists reported that an important function of the coordinator was to act as an advocate for the programme. The therapists perceived the coordinator had experience in fall prevention, so was well positioned to liaise with management and assist with introducing the service.

One physiotherapist made the point:

Because the co-coordinator knew more about the programme, they were able to promote it far better than I could. You were there to answer their questions, whereas, I wouldn't have been able (PT1).

Another physiotherapist commented:

Instead of me having to sell the role and programme to them it was nice having someone official who could email and just add a bit of weight to the request for some extra time. It also gave the programme a sense of legitimacy, it was a real programme (PT2).

Sub-theme: Professional network

As discussed in Chapter 4, there was a network of 4 physiotherapists and the co-ordinator. Our findings showed that through the network, despite geographical isolation, physiotherapists were able to work together on the common programme. One physiotherapist said; “It gave a chance to network with other Physiotherapists” (PT2). Another elaborated; “The networking was one of the most helpful things. It gave me new ideas and much reassurance. We were all working together with the program” (PT1). It is acknowledged that providing professional development and support could help remove the sense of isolation practitioners experience in the rural setting (Herrington & Herrington, 2006; Schoo et al., 2005; Sheppard, 2005). The above comments suggest the physiotherapist network provided an effective means of achieving this.

Sub-theme: Minimal equipment

Budget and time constraints typically limited practitioner access to additional equipment. The physiotherapists appreciated that the programme required little additional equipment and that any specific items of equipment were made available for loan. This both reduced the cost burden to the physiotherapy department and augmented the programme's versatility. As one

physiotherapist pointed out, minimising the programme's cost increased the chances of gaining management approval:

Even the fact that the equipment was provided, that was really helpful because we do have a limited budget and we're sort of all the time, we're buying plaster and those things that are in the everyday running of the department. So it was good to have things provided for us like the balance mat and the steps, things like that had been really helpful because it's just given us so much more to be able to go on with. It's made the programme more interesting too, I think...One of the time consuming things is having to go and order equipment and make sure that you've got it there.....and I think that's one of the things that has been really good for us, that it hasn't cost us a lot of money, I think that's probably why management have been really supportive because they didn't see it as a major thing (PT4).

Cost is an important factor in many management decisions. The above quotations illustrate that the present programme took costs into account.

Sub-theme: Volunteer assistants

From the physiotherapists' perspective, volunteer assistants eased their burden and boosted their confidence for providing the programme. This assistance was seen as vital to efficient and effective delivery of the programme. One physiotherapist expressed it this way:

I definitely think the volunteers are really important to me. I would have been absolutely terrified to run a group with that many frail type people on my own and I think they [*participants*] would have picked up on that because I would have had them all standing in a line or something and I would have been standing behind them, I wouldn't have been able to let them out of my arm's reach and I don't think you'd be able to do it. I mean you could if they were like [*participant's name*] maybe, but you wouldn't have been able to invite anyone that was actually challenged with transfers and stuff which we did have in the group, to be able to do it (PT3-MC).

Another physiotherapist emphasised:

I don't think you'd be able to run it without the volunteers. Volunteers were there to help if they went wrong. At some stations you need to have someone there, for example the clock exercise, they were invaluable (PT4).

Despite overwhelming support for the inclusion of volunteer assistants in classes, one physiotherapist cautioned that selection of the 'right' volunteers was important. Her comment points to the importance of developing selection criteria to assist in recruiting suitably qualified volunteers:

If you've got a good volunteer, they were really good because they would chat away and help the patient and they were really good to encourage the patient. Whereas if you got one that just stood there and watched them and didn't participate, as I had one, it just wasn't, didn't work. I think choosing volunteers is really, really important (PT4-MC).

In general, participants spoke favourably about volunteer assistants' contribution to the classes. However, participant 54 was one exception:

They were trying to encourage us. It irritated me a little to start with. Almost as if they were being condescending. You don't need to go overboard in the praise of something. [*physiotherapist's name*] can't be around for everyone at the same time, I thought it was a good idea (IP54).

Volunteer 11 also drew attention to the importance of considering the type of feedback provided by volunteers and the manner in which feedback is provided. The comments of participant 54 and volunteer 11 provide helpful insights, which, if addressed as part of volunteer training, may enhance the volunteer's contribution to the programme:

Encouragement - reinforce what they are doing well and don't knock what they are doing not so well. By letting them do what they can to be independent and not taking over their role. It is important that volunteers aren't too overpowering (VA11).

9.3.3 Capacity building

The above mentioned facilitators moderated the barriers, increasing the ease and ability with which physiotherapists and the health service could provide the programme. Through the process of delivering the programme, the physiotherapists and volunteer assistants gained experience and confidence, which led them to feel more comfortable with, and capable of delivering, the fall prevention programme. In addition, physiotherapists reported being more confident to liaise with management about the delivery of future programmes. Hence, a major outcome of programme delivery was that it built local capacity to provide future programmes. One physiotherapist said; "Now I have the resources to do it. I would have been thinking what should I do? I hadn't done a lot of it at University". She reflected; "It has been a learning experience for me. I have lots of ideas now and a lot more resources. I have also seen how I can use the resources I have" (PT3). A second physiotherapist spoke of her increased confidence to deliver the programme; "The first time was really challenging time-wise. Everyone was so different. So you really had to think to design the programme. Next time, I won't bat an eyelid". This physiotherapist was also more confident to advocate for future programmes; "Because I know more about the programme and I feel confident I could go in and justify why I need to

spend one and a half hours per week on the programme” (PT1). Another physiotherapist summed up her experience in the following way:

I am pleased I did it, it was very beneficial for me. I learned lots. It increased my skill and confidence in delivering a circuit programme like this. Now I have something I can pull out and give. It is nice to stretch out a bit and do something very applicable to our population because we have a lot of older people (PT2).

The capacity of volunteer assistants was also built. They spoke of knowledge and confidence developed through helping to deliver the programme:

As I went along I got a ‘hands on’ experience and you learn as you go. If there was anything I wasn’t doing right, [*physiotherapist’s name*] the physiotherapist corrected it (VA4).

It made me aware of the ‘type of exercise’ for balance. Knowing doing this and this and this would improve balance, you don’t have that association really. I wasn’t aware of how many people were having falls. It has opened my eyes to think these small tasks we do here and just a basic exercise programme could help these people prevent a fall (VA5).

According to the New South Wales Health Department–(NSW Health Department, 1999), what is important, beyond sustainability of the current program is the capacity of the individual .As discussed above, delivering the programme built physiotherapist capacity to provide future programmes. An interesting finding was that the experience of delivering the programme also built physiotherapist capacity for providing interventions to a range of client groups. One physiotherapist explained:

Yes, it gave me some ideas to use with some of my stroke patients, anyone in rehab who has balance issues. This is something I hadn’t done a lot with before. I had looked at strength and flexibility but not balance. It also applies to a lot of the orthopaedic patients as well. For example, those with decreased proprioception after knee replacement (PT3).

Another physiotherapist agreed:

I will probably incorporate more of these falls prevention exercises into the more general exercise programmes. Example, cardiac rehab. and hydro, I can see the benefit of some of these more specific exercises as an adjunct to these (PT2).

9.3.4 Acceptability

Participant comments reflect a high degree of engagement in the programme. Overall, participants talked enthusiastically about attending the classes. There were numerous references to 'looking forward' to going. Participant 12 said; "You look forward to it, to that day". Another participant commented; "I looked forward to coming, having a laugh and a giggle, it wasn't a chore" (IP20). A volunteer agreed; "They all seemed fairly dedicated to come each week and were disappointed if they couldn't make it. I don't think there were any that didn't want to come each week" (VA5).

Several respondents recommended that the programme be ongoing:

I just felt that the overwhelming thought by everybody was it needs to be an ongoing thing (VA15-MC).

You know, I think, generally speaking it would improve their general lifestyle wouldn't it, you know if people still sort of follow them and the only thing probably is that they may need a follow up of some sort you know at some stage to reinforce what's happened before and also to give them another bit of a kick along sort of thing, towards the main aim (IP61-MC).

A physiotherapist made the following suggestion:

I would like them to keep the home programme as an ongoing thing, a lifestyle change. Maybe if you got them back on a one-on-one basis, a call back session at six months that would be a motivation thing for them and to pick up on any falls or problems they may have had (PT4).

Volunteers commonly have a mix of altruistic and egotistical reasons for volunteering (Volunteering Australia, 2006). Volunteer comments, throughout this chapter, indicated they enjoyed being part of a group and partaking in reciprocal relationships. They were also informally rewarded by seeing the benefits for others and a sense that they had made a difference to participants and physiotherapists. Given the valuable contribution volunteers made in the present program, the ability to retain them is important. Retention may be assisted by promoting these identified incentives to volunteering.

When participants were asked whether they would attend the programme, should it be offered again: 60 (86%) selected 'yes'; 7 (10%) selected 'no'; and 3 (4%) were 'unsure'. All four physiotherapists and 16 (94%) volunteer assistants expressed an interest in providing future fall prevention programmes. The following comments reflected the generalised interest in continuing with the programme:

I would jump at it, to be able to help a new group of people. Initially I jumped at it to be able to help people get new skills. But having done it I can see the benefit the ladies got out of it and I think that can only be a positive (VA13).

I'd definitely like to run 'Fit and Free' again. It was easy. I am comfortable with it and can recognise the specific benefits of this programme (PT2).

It is widely acknowledged that achieving ongoing participation is a challenge of any exercise programme (National Ageing Research Institute, 2004). However, the above comments reflected an overwhelming interest on the part of participants, physiotherapists and volunteer assistants to continue with the programme. Sustainability of the programme will be discussed further in Chapter 10.

9.4 The starting grounded theory

The qualitative study which explored participant, volunteer assistant and physiotherapist perspectives was intended to add depth to the research. This section draws together findings presented earlier in the chapter, to create the starting theory which underpinned the whole programme. As described in Chapter 7, the theory was grounded in data systematically gathered and analysed in accordance with the Strauss and Corbin (1990) School of Grounded Theory. Figure 9-4 shows the contextual features, intermediary features, phenomena and interrelationships between the parts.

As discussed earlier (see Section 9.1, Figure 9-1), a major finding was that three attributes (contextual factors) facilitated participation (uptake and adherence) in the programme. These attributes were identified as 'group exercise', 'type of exercise' and 'delivery format'. The present section considers these attributes in relation to the starting theory (Figure 9-4). In outlining the starting grounded theory, it is important to emphasise that the factor 'delivery format' entails different components when considered from a participant vs. provider perspective. From the participant perspective, 'delivery format' incorporated the components of a 'user-friendly structured approach', and 'complementary class and home programmes'. From the provider perspective, 'delivery format' incorporated the subthemes ; 'packaged programme', 'coordinator', 'professional network', 'minimal equipment' and 'volunteers to assist'.

From the provider's perspective, participation in the programme related to delivering the intervention. The contextual factor 'delivery format' facilitated provision of the programme. That is, specific features of the programme and its implementation method assisted in overcoming barriers and increased the likelihood of the programme being successfully delivered (Figure 9-4). Moreover, the experience of delivering the programme, led to a phenomenon

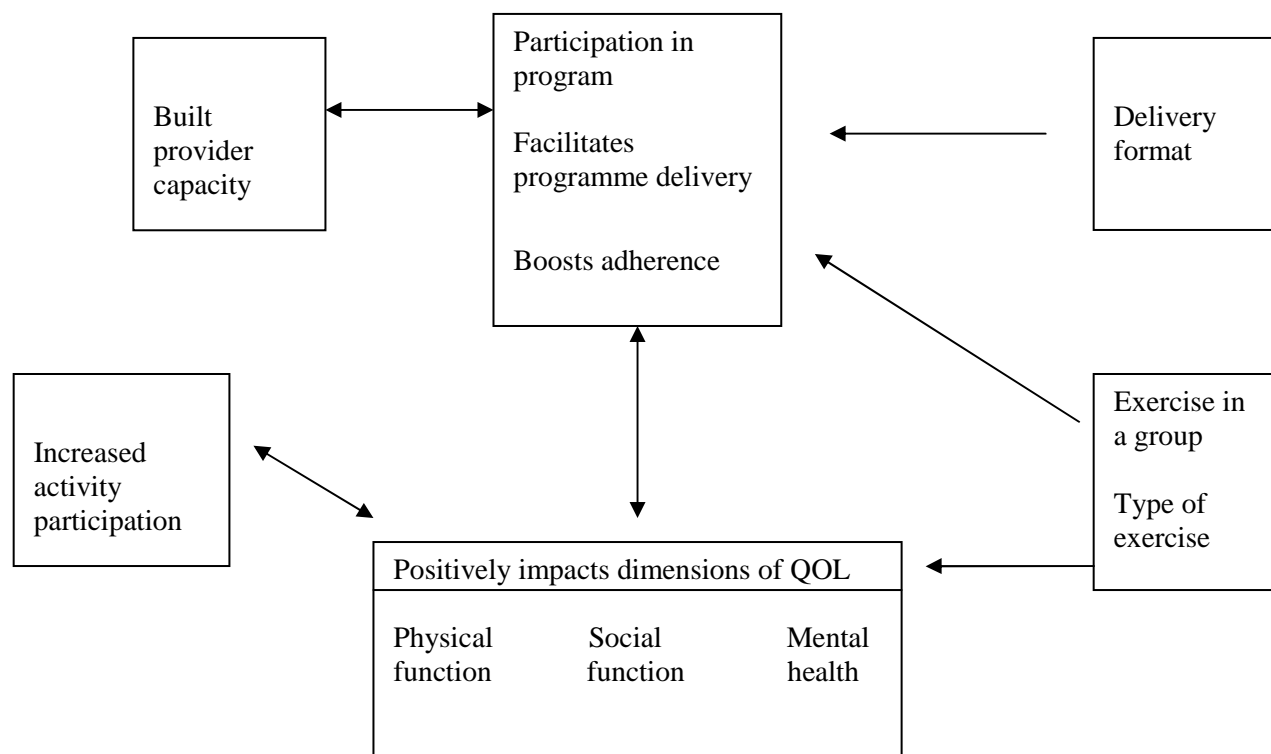
entitled in the present study 'built provider capacity'. In particular, the physiotherapists and volunteer assistants appeared better positioned to deliver and advocate for future fall prevention programmes.

For participants, 'partaking' equated to commencing and continuing in the programme. Analysis and interpretation identified that three contextual factors ('group exercise', 'type of exercise' and 'delivery format') increased confidence in performing the programme and motivation for continuing. These factors contributed to programme efficacy, broader outcomes and adherence. Participation in the programme (intermediary factor) impacted physical, social and mental health dimensions of QOL. 'Positively impacts dimensions of QOL' was identified as the primary theme because of its centrality, frequent occurrence and good connections to the other categories. In a cyclical manner, the physical, social and psychological benefits of participation motivated ongoing programme participation and led to increased overall activity levels (Figure 9-4). The two contextual features, 'group exercise' and 'type of exercise' also directly impacted on the participant's physical, social and psychological function, as was reported in the interviews.

The starting theory, while not intended to provide a full explanation, identified important parts and assisted understanding of relationships between these parts, thereby adding richness to the study. Notably, the theory increased understanding of the relationship between the intervention and dimensions of QOL. However, the study also identified individual variation in the mechanism for change in QOL. For example, findings indicated that changes in physical function were important to some participants, whereas others placed more emphasis on social benefits. This may, as suggested by McAuley and Katula (1998), have been influenced by the outcome(s) of greatest concern to the individual.

Chapter 3 of this thesis highlighted the need for further qualitative research examining the process of fall prevention interventions. Overall, the starting grounded theory of the present study, based on the views and experiences of respondents, increased understanding of programme processes and outcomes. It was intended that the insights gleaned would assist in refining and developing the current programme and inform the development of future fall prevention programmes. Moreover, it is likely that incorporating varied qualitative methods across future fall prevention trials may increase understanding as to the most beneficial qualitative approaches for the collection and analysis of data related to intervention processes.

Figure 9-4: A starting grounded theory of the intervention: Processes and outcomes



9.5 Summary

Interview transcripts from participants, volunteers and physiotherapists were analysed and interpreted. As a final part of the research, a starting grounded theory was presented to assist understanding of the intervention's processes and outcomes and the interconnectedness of the parts to the whole. Attributes of the intervention identified as 'group exercise', 'type of exercise', and 'delivery format', were recognised to boost participant confidence in performing the programme and motivation for continuing. Participation appeared to impact the physical function, social function and mental health dimensions of QOL. From the provider's perspective, several barriers and facilitators were identified to programme delivery. Facilitators enhanced the ease and confidence with which physiotherapists were able to provide the intervention. The experience of delivering the programme built local capacity to provide future fall prevention programmes.

CHAPTER 10: DISCUSSION AND CONCLUSION

10.1 Introduction

The preceding chapters have reviewed, synthesised and integrated a wide range of literature and provided the conceptual and methodological aspects of the present research. They have presented the analysed and interpreted data gleaned from the study. This chapter draws together the quantitative and qualitative aspects, to provide a summation of the whole study and address the research aims. It discusses the main practical contributions, considers the study limitations and provides suggestions for future research.

The primary aim of this study was to examine the relationship between participation in the exercise programme and measures of fall risk factors. It addressed the question ‘Will a balance-training exercise programme significantly reduce fall risk factors for community-dwelling rural older people?’ The secondary purpose was to explore and answer the question, ‘What were the programme’s processes and outcomes?’

10.2 Overarching summary of the findings

The present research makes an important contribution to the literature. It does this by being the first RCT with an embedded qualitative study to examine a fall prevention exercise programme implemented in a rural Australian context. Both quantitative and qualitative methods were important to the study aims and contributed to a comprehensive understanding of the intervention.

The RCT demonstrated that a 13 week exercise programme significantly decreased risk factors for falls and suggested a trend towards reduction in the incidence of falls. These findings add to growing evidence that this type of balance-training exercise programme is effective in reducing risk factors for falls.

The qualitative study yielded important insights concerning what was most valued by elderly rural persons and reasons they wished to participate in the programme. In particular, it identified social isolation and lack of transport as key issues to be addressed in order to improve QOL. It also highlighted that anticipated and actual benefits in QOL were important motivators of uptake and adherence. Moreover, the qualitative study associated specific programme attributes

(group exercise, type of exercise and delivery format) with promoting QOL, self-efficacy and adherence.

This study demonstrated that the intervention was feasible for implementation in a rural context. It highlighted barriers to implementation that were directly related to or magnified by the rural context. Barriers identified included; limited resources to provide the programme, little physiotherapist experience in fall prevention and the need to canvas management approval. The five main facilitators to implementation were; having a coordinator, packaged programme, professional network, volunteer assistants and requiring minimal equipment. These facilitators addressed identified barriers by increasing the physiotherapists' confidence and capacity to deliver the programme.

10.3 Preventing falls in rural contexts

Around 32% of Australians live in rural and remote areas (Australian Institute of Health and Welfare, 2008a). One of the most striking disparities between rural and metropolitan areas is the limited access to, or reduced availability of, health services (Australian Institute of Health and Welfare, 2008a, 2008b; Bourke et al., 2004; Larson, 2002; National Rural Health Alliance, 2005). Hence, research is needed to address health issues and determine models of service delivery that will work effectively in rural communities.

Falls among the elderly is a serious public health concern because of its frequency, associated morbidity, mortality and health care costs especially when viewed in the context of projected demographic changes over the next 30 years. Falls are a particular problem in rural Australia, where the ageing population is more marked. Their health is generally poorer and they have less access to health services. Furthermore, unique contextual factors are likely to necessitate novel approaches to fall prevention in rural areas (National Ageing Research Institute, 2004).

Impaired balance and mobility has been identified as one of the strongest risk factor domains for falling (Lord, Sherrington, Menz, Close et al., 2007b). There is evidence that balance-training is effective in reducing rates of falls in community-dwelling older adults. However, further research is required to elucidate programme components important for preventing falls.

Worldwide, despite the growing body of knowledge and evidence on fall prevention exercise interventions, clinical practice has lagged behind (Close et al., 2003; Tinetti, 2001). Hence, a remaining challenge is to incorporate fall prevention exercise programmes into everyday

clinical practice, with good effect and acceptance (Bloem et al., 2003; Close, 2005b; Elley, 2008). Notably, gaps in evidence and practice are magnified in rural contexts, where a paucity of studies has investigated fall prevention exercise programmes. In particular, no RCT has investigated the effectiveness of a single intervention fall prevention exercise programme in a rural Australian context. Two published multi-component rural Australian studies, which incorporated an exercise component, provide some insights but little specific guidance in terms of implementation (Brown, 2004; Kempton et al., 2000).

Findings of the present study indicate that the fall prevention intervention was effectively implemented via a hub and spoke model into a range of rural communities across the upper Hunter-New England region of NSW. Furthermore, it was implemented into real life clinical settings, incorporating usual physiotherapists at the local hospital.

One hundred and fifty persons were recruited. The average age of participants was 77 years. Most participants were female (82%) and lived independently (93%) in the community. The complexity of participants' medical problems was reflected in their average number of co-morbidities (5.4) and number of medications (5.0). These findings are consistent with demographics described elsewhere. In particular, the median ages for Australia's rural areas are generally higher than for the cities (Australian Bureau of Statistics, 2007). Nationwide there are more women than men in the 65 years and above age bracket (Australian Bureau of Statistics, 2008b). Around 94% of Australians aged 65 years and over live in private dwellings in the community (Australian Institute of Health and Welfare, 2007). Rural dwellers have poorer health than their city counterparts, reflected in generally higher levels of disease and morbidity (AIHW, 2008a; Welch, 2000).

10.4 Effectiveness of the intervention

The present study found a significant between-group difference in both primary outcome measures; PPA composite score (a measure of overall falls risk) and BBS score (a measure of different aspects of balance). Previous similar studies found a between group difference of around 0.3 in the PPA (Liu-Ambrose, Khan, Eng, Janssen et al., 2004; Vogler et al., 2009). This study showed a larger between group difference (0.44).

Of interest was that only a small difference in the BBS score was detected. According to Blum and Korner-Bitensky (2008), while the BBS generally has strong psychometric properties for assessment of balance across a range of populations, it may not detect meaningful changes when

used to assess persons who have mild balance impairment. Interestingly, Salback et al. (2001) found a large ceiling effect and results of the present study indicated a ceiling effect. Our participants lived independently in the community, which implies a relatively high level of function. So it is possible that the BBS failed to detect some clinically meaningful improvements, beneficial for independent living and leisure participation. However, because the BBS examined functional tasks, a change in score, even if only a small difference as in the present study, was expected to represent improved ability for real life activities. Interestingly, qualitative findings showed participants noticed improved physical function (e.g. balance and coordination) that translated into increased functional abilities and they felt this was of benefit to them. Qualitative findings were supported by responses to closed interview questions. For example, 86% of participants reported that as a result of doing the programme, their balance had improved.

Given the possible ceiling effect of the BBS, Blum and Korner-Bitensky (2008) suggest clinicians consider complementing the BBS with other balance measures. Similarly, findings of the present study highlight the importance of using a range of quantitative balance measures as well as qualitative methods to investigate outcomes of fall prevention exercise programmes in community-dwelling older adults.

The present study also showed significant between-group differences for several secondary outcome measures; average knee extensor strength, hand reaction time, sway on foam with eyes closed, choice stepping reaction time and timed stand on one foot. Furthermore, for several outcome measures there was an indication that the intervention had a greater effect in people with lower baseline scores.

The RCT was not powered to show an effect on fall rates. However, falls were measured to assess for adverse events, and so trial data could be used in future meta-analysis. Results showed a trend for a between-group difference in the proportion of people who had one or more falls in the follow-up period, but this was not statistically significant (odds ratio from logistic regression model 0.53, 95% CI 0.27 to 1.03, $z = -1.87$, $p = 0.061$). There was also an indication of a lower rate of falls in the intervention group compared to the control group (IRR 0.92, 95% CI 0.51 to 1.63, $z = -0.30$, $p = 0.767$), but this result was also not statistically significant. These results point to the need for a further, larger study, with the power to detect change in falls. Importantly, no major injuries were related to the programme, only minor musculoskeletal discomfort, indicating that the intervention was safe for elderly persons.

There is currently limited evidence identifying the relative benefits of specific exercise programme components for optimal fall prevention. Recent systematic reviews and meta-analyses (Lord, Sherrington, Menz, Close et al., 2007b; Sherrington, Whitney et al., 2008) identified balance-training as a common thread of exercise programmes that effectively prevented falls and found good evidence to support an exercise dose ≥ 50 hours. There was also some evidence to support tailored intensity. Neither progression or functional task training had distinguished 'successful' from 'unsuccessful' programmes (Lord, Sherrington, Menz, Close et al., 2007b; Sherrington, Whitney et al., 2008).

Although balance-training is increasingly being recognised as an important feature in fall prevention exercise programmes, a range of disparate exercise activities have been included under the umbrella of balance-training (National Public Health Partnership, 2005b). The present findings support the use of a balance-training exercise programme in reducing fall risk factors. Furthermore, the results support the inclusion of specific exercise components within a balance-training exercise programme, in particular; tailored intensity, progressed difficulty, functional task training, regular supervision and a relatively high dose of exercise (approximately 33 hours over 13 weeks / 90 hours over one year). However, further research is needed to determine the individual effect of each component.

Given that occasions of exercise waned over the succeeding months, research is required to determine ways of continuing this or a similar program, in order to promote the ongoing physical and psycho-social benefits. Robertson et al. (2001) demonstrated that a tailored exercise program delivered by specifically trained nurses within general practice was effective for reducing falls. Given the shortfall of rural physiotherapists, perhaps the positive trend seen in the present study could feasibly be continued in community groups led by specifically trained health professionals, such as nurses and exercise physiologists, supported by volunteer assistants. As demonstrated by Robertson et al (2001) physiotherapists could play a role in training these instructors and contribute to the programmes on a consultative basis.

10.5 Study design issues

10.5.1 The mixed methods design

Whereas the majority of fall prevention exercise intervention studies have used quantitative methods, this single complex study was based on a mixed methods design. Consistent with an

embedded experimental model, the RCT addressed the study's primary aim and the embedded qualitative study addressed the study's secondary purpose.

The underlying logic of mixing methods was that neither a quantitative nor qualitative method would have been sufficient in and of itself to capture the trends and details of the intervention. Used together, these methods were expected to complement each other, adding depth and breadth to the study, thereby providing a more complete understanding. In particular, inclusion of the qualitative study was intended to portray participants' and providers' actual experience in ways the quantitative aspects of the study could not. Moreover, the use of multiple data sources, with respect to person and site, promoted a richer account and elucidated the practice contexts of the intervention, providing useful information for others wishing to translate and transfer the findings to their practice settings.

In interpreting the findings, limitations associated with the qualitative inductive approach must be acknowledged. First it is important to note that this qualitative study explored perceptions and experiences of those involved in a fall prevention exercise programme implemented into the upper Hunter-New England, as an example of a rural community. The variation within the present study, in terms of both participants and settings, was anticipated to enhance transferability and contribute to the body of knowledge on rural fall prevention exercise programmes. However, qualitative studies undertaken in other settings, with other participants and providers, may present a different picture. Hence, further research across a range of rural communities and settings is required to extend this body of knowledge.

Second, important programme components and outcomes were identified by subjective synthesis rather than between group differences. While this approach allowed speculation about components and outcomes, there is need for additional evaluation. Future research could build on these qualitative findings and experimentally evaluate the relative effect of programme components on outcomes and adherence. Third, due to budget and logistic constraints, the researcher undertook all interviews. This promoted consistency but may have adversely impacted findings. For example, respondent reports may have been influenced by a desire to please the researcher. Therefore, future studies may benefit by assigning an independent person to conduct the interviews.

10.5.2 *The RCT design*

Several strengths of the RCT design promoted meaningful results. First, because functioning is complex in older people (World Health Organisation), this study incorporated a number of tests

to measure the effects of this exercise programme on different aspects of health and physical function. Second, the study design controlled for many threats to internal validity. After baseline assessment, an off-site physiotherapist randomly assigned participants to the intervention and control groups using computer generated random numbers (i.e., a concealed randomisation procedure). The similarity of groups at baseline for all demographic and health status variables demonstrated effective randomisation. Assessors were blinded to group allocation. Analysis was performed on an intention to treat basis. As many people as possible were reassessed, including those unable to complete the full assessment and participants who had complied poorly with the exercise programme. Further, the RCT recorded a low drop out rate (7%) at follow-up assessment.

Third, several design features were intended to increase the study's external validity. A variety of recruitment methods were used. There were few exclusion criteria and most participants experienced multiple co-morbidities. Participants were drawn from a wide age range and several geographic locations of varying socio-demographic profiles. Moreover, physiotherapists at the local hospital delivered the programme, indicating that it was feasible to be accommodated under existing workloads and in that particular setting.

Finally, the study used measurement tools for which validity and reliability had been previously demonstrated. Thus, strategies used to promote internal validity gave confidence in the conclusion that differences between the groups were due to the intervention. Furthermore, strategies used to enhance generalisability suggested results would be broadly applicable. However, generalisability of the intervention's effects needs to be determined in other rural healthcare settings.

There are several limitations to the RCT findings. First, a longer follow-up period was needed to determine whether the effects of the programme were maintained beyond the 13 week period. Although the incidence of falls were measured over a one year period, time and budget constraints did not permit assessment of primary and secondary outcome measures past 13 weeks. Hence, future studies with long term follow-up are needed to determine whether clinical improvements are maintained. Second, as is typical of fall prevention trials, fall data was self-reported and therefore subject to recall bias. Third, participants in exercise studies cannot be blinded to group assignment and this may have influenced outcomes. Finally, the study sample was predominately female. However, this distribution by gender is more reflective of the population at this age than would be an equal ratio of men and women.

10.6 Process and outcomes

10.6.1 *Quality of life*

Older adults identify important components of successful ageing and QOL as good physical, mental and social function, together with control and independence. Fall prevention interventions have been shown to influence many aspects of a person's life and positively affect QOL. However at this point in time, research is required to determine the type of fall prevention interventions that effect QOL and the means by which they impact QOL. To address this gap in the literature, the present study looked at the effect of the balance-training programme on QOL and explored mechanisms by which the intervention impacted QOL.

Previous studies indicate that physical function (Elavsky et al., 2005; Vaapio et al., 2008), self-efficacy, and group activities (Fukukawa et al., 2008; Vaapio et al., 2007) can play a role in the physical activity-QOL relationship. Findings from the present study suggest that the programme positively impacted physical function, social function and mental health domains of participant QOL. The program also positively influenced sense of control and independence, both important components of QOL for older persons (Bowling et al., 2003; World Health Organisation, 2002). Notably, 'positively impacts QOL' was identified as the primary theme of the starting grounded theory, because of its centrality and good connections to other categories. These findings concerning the effect of the programme on QOL, to be discussed in detail below, highlight the need for further in-depth qualitative research to elucidate the relationship between fall prevention exercise programmes with a social component and QOL.

Physical function

With advancing age there is increased susceptibility to functional disability (Elavsky et al., 2005) and decreased self-efficacy (Bandura, 1997). It is recognised that physical activity can improve functional ability and increase self-efficacy. Consistent with several studies (McAuley et al., 2006; Netz et al., 2005; Seeman & Chen, 2002), findings of the present research suggest that improved physical function and increased self-efficacy often went hand-in-hand. In particular, quantitative results demonstrated enhanced physical function and reduced risk of falls. Intervention participants also described improvements across a range of physical parameters (balance being the most commonly cited improvement), together with a better ability and increased confidence in undertaking daily tasks. At interview, 86% of intervention participants reported improved balance and 80% said they were less frightened of falling.

Moreover, many participants reported to have increased their overall activity levels and some reported renewed uptake of ADLs, such as housework and gardening.

Findings of the present study support the hypothesis that balance-training is likely to increase confidence in balance. This in turn may have beneficial consequences for activity levels and a positive effect on physical functioning, fall risk and QOL (Rizzo, Baker, McAvay, & Tinetti, 1996; Yardley, Donovan-Hall et al., 2006). Findings of the present study also lend support to recommendations that prevention interventions for older adults at risk of functional decline and falling attempt to simultaneously improve physical function and confidence (Liu-Ambrose, Khan, Eng, Lord et al., 2004; National Institute for Health and Clinical Excellence (NICE), 2004b; Tinetti et al., 1994).

Interestingly, although the qualitative findings pointed to improved physical function and performance on ADLs, no between-group difference in ADL scores on the Guralnik questionnaire were detected. As most participants lived independently in the community and were fairly high functioning from the outset, it is possible that the Guralnik questionnaire was not sensitive enough to detect changes in the quantity and/or quality of participants' ADLs.

Social function

Older people view social contact as an important component of successful ageing and QOL. However, they often miss opportunities to engage in social networks, due to poor functional ability, reduced self-efficacy and self-imposed activity limitations (Ward-Griffin et al., 2004). The large distances and poor availability of public transport which characterise rural Australia (National Rural Health Alliance/Aged and Community Services Australia, 2005; Wakerman & Humphreys, 2002) have the potential to magnify issues of social isolation. Over three-quarters of participants in the present study lived alone. Qualitative findings highlighted lack of companionship and opportunities to socialise, and identified social isolation as a major issue. As earlier indicated, these findings suggest that social isolation may be worthy of special consideration in future rural fall prevention studies.

The inclusion of a social component assisted in addressing issues of loneliness and isolation, and contributed strongly to programme outcomes. Notably, the social aspect turned out to be one of the most highly valued elements of the programme. Participant comments described connecting with others, the importance of relationships formed, and inferred a sense of belonging. Reciprocity was a noteworthy feature of the groups; participants and providers took an interest in each other, shared broader aspects of their lives, and gave and received support. The WHO (2002) contend that older people seek both independence and inter-dependence. It

seems the social element of the present programme provided a forum for inter-dependence and the exercise programme contributed towards maintaining independence. Findings of the social benefits and enhanced social function that stemmed from the programme support recommendations that persons designing fall prevention programmes in the future should promote the social value of such programmes (National Institute for Health and Clinical Excellence (NICE), 2004a) and consider avenues for continued implementation in the community.

Mental health

Increased proficiency for daily activities could conceivably impact participants' perceived and actual ability to cope, as well as be in control and independent. Many participants reported increased confidence and ability in undertaking daily activities. Several participants described how increased confidence in their abilities had led them to feel more in control of their situation and their lives. These findings were consistent with previous research, highlighting the potential of fall prevention programmes to act as a resource in promoting independence (Commonwealth Department of Health and Aged Care [Marketing Consultancy Network Inc], 2000; Stead et al., 1997; Yardley, Bishop et al., 2006). Moreover, these findings suggest it may be advantageous to design fall prevention exercise programmes so as to maximise perceived control and independence, and use these as selling points when promoting such interventions.

Quality of life

As discussed above, the qualitative findings indicate that the programme positively impacted domains of QOL. Despite a trend towards improvement on the SF12 (physical component scale 1.65 (-1.22 to 4.52), $p=0.257$), the RCT detected no significant between-group differences in the SF-12. However, it is widely acknowledged that there are inherent difficulties in measuring QOL. In particular, QOL has been poorly defined (Bowling, 1995; Bowling et al., 2003; Hass, 1999; Vaapio et al., 2008), and is a highly individual concept that cannot be adequately assessed using standardised measures (Higginson & Carr, 2001). Indeed, Lin et al. (2007) argue that statistical significance of change in QOL scores implies little about the clinical significance.

Although the SF12 is a commonly used health related quality of life scale and recommended as an outcome measure in fall prevention studies (Lamb et al., 2005), the SF12 was developed for generic use. It cannot be assumed that generic instruments will perform well in an older population. In particular, generic instruments may miss items which elderly people rank as important (Bowling, 2005; Vaapio et al., 2008). For example, the SF12 contains just one item related to the social dimension of QOL. Yet older people identify social function as a key aspect of 'successful ageing' (Bowling et al., 2003; Bowling et al., 2007; Phelan et al., 2004; von

Faber et al., 2001). One of the most consistent findings of the present study was the extent to which participants reported to have enjoyed and benefited from the social aspects of the programme. These findings support Bowling's (1995) suggestion that a qualitative approach may be one means to overcome some of the shortfalls of standard QOL instruments. The present findings also fit with Vaapio and colleagues' (2008) recommendation that fall prevention studies use both quantitative and qualitative methods to evaluate an intervention's effect on QOL.

Overall, the trend towards improvement on the SF12 (physical component scale) and improvements in QOL indicated by the qualitative study, are important findings worthy of further investigation. Use of a mixed methods design could assist understanding of programme impacts on QOL. For example, future quantitative research using a larger sample size may demonstrate a statistically significant improvement in the SF12. Alternatively, the SF36 may be more sensitive to change. Additionally, future qualitative research using in-depth interviews, with questioning going beyond the immediate programme could explore longer term program impacts on QOL.

10.6.2 Building self-efficacy

Efficacy beliefs can be changed (Clemson et al., 2004; King et al., 1992; Tennstedt et al., 1998) and although little researched, the application of efficacy-building strategies to fall prevention exercise programmes has the potential to positively impact outcomes. The present study did not actively target self-efficacy. However, several programme components incorporated Bandura's (1982) efficacy-building strategies and the qualitative findings suggest this programme built self-efficacy. Participants spoke of improved ability for everyday activities and referred to or inferred increased confidence in undertaking everyday tasks. Few fall prevention trials have specifically aimed to build self-efficacy (Cheal & Clemson, 2001) and findings of the present study suggest that Bandura's theory (1982) may be readily applied to fall prevention exercise programmes.

Exercise prescription

Findings of this study consistent with Bandura's theory (1986), the findings of Cheal and Clemson (2001) and Tinetti et al. (1994), suggest that training promotes self-mastery experiences which foster the development of self-efficacy. Furthermore, specific programme components (tailored, progressed, and functional exercise) were implicated with mastery experiences. Tailoring and progression helped pitch the exercises at a suitable level, safe yet challenging. Lorig (1986) and McNeill et al. (2006) identified that goal attainment increased

confidence and motivation. Findings of the present study found that goal attainment and the progression from easier to harder variations demonstrated improvement and may have assisted to build self-efficacy.

Bandura (1995) recommends practice and mastery occur in real life circumstances. Moreover, functional training has been recommended as a means to optimise performance on everyday tasks (Carr & Shepherd, 1998). The present study identified that a particular benefit of functional exercise was that it provided opportunities for mastery experiences on everyday activities.

Bandura (1997) also proposes that regular exercise can act as a powerful source of efficacy information. It is plausible that the relatively high exercise dose achieved by combining class and home programmes, and the regular opportunities for practice afforded via the home programme (Lorig, 1986), promoted mastery experiences and helped build self-efficacy.

The affective experience of the exercise

A person may experience positive affect through participating in exercises (McAuley et al., 2003) and use information about their physiological and emotional states to judge their capabilities. This information can help to strengthen perceptions of capabilities, and influence subsequent behaviour (Bandura, 1997). The present study's findings, consistent with those of Clemson et al. (2003), suggest that the affective experience of the exercises had been an important aspect of the programme. For example, participants described better balance, feeling stronger and increased coordination. Others spoke about the decreased physical impacts of co-morbidity. Such improvements appeared to motivate participants and conceivably contributed to increased self-efficacy.

Group exercise

There is ongoing controversy as to whether fall prevention interventions are best delivered on a group or individual basis. The present study's findings highlighted several means by which 'group exercise' may have contributed to increased self-efficacy. First, the group sessions provided access to supervision, feedback and encouragement, which promoted correct technique and optimal challenge and safety. This is important because to be effective, fall prevention exercises need to safely challenge balance (Sherrington, Whitney et al., 2008). Access to supervision and support also helped address concerns of persons with pain or mobility limitations. According to Leveille et al. (2003), persons in these circumstances may need to be convinced about the safety of the exercises and the environment. For example, Leveille et al. (2003) recommended a volunteer escort when undertaking new exercises. In the present study,

numerous respondents commented on the benefits of having a volunteer assistant ‘shadow’ some of the less physically able participants.

Performing exercises in a supervised class environment built participant confidence to continue at home, thereby permitting access to an increased volume of exercise. Furthermore, correct technique, optimal challenge and safety were likely to have promoted mastery experiences, thereby building self-efficacy (Bandura, 1986, 1995).

Second, it has been suggested that positive and realistic feedback from facilitators and peers can encourage people to try harder and promote self-efficacy (Bandura, 1986; Bandura, 1997). At the group session, participants were provided with verbal encouragement and recognition of their achievements (see Chapter 9 section 9.1.1). This motivated performance and may have contributed to enhanced self-efficacy (see Chapter 9 section 9.2.3). Third, it seems the social support and positive affect generated from ‘group exercise’ contribute to enhanced self-efficacy. This is consistent with information that pleasant experiences can strengthen beliefs about capabilities and be conducive to growing self-efficacy (Bandura, 1997). Fourth, Bandura (1982) argues that efficacy may be influenced by the experience of witnessing another. Volunteer assistants and physiotherapists recounted that participants had watched others perform an exercise and gained confidence to ‘have a go’ themselves. Hence, it is plausible that witnessing others at classes contributed to enhanced self-efficacy.

An empathetic group atmosphere was fostered by participants being in the ‘same boat’ in terms of age, their experience of co-morbidities and common focus of the exercise programme. Bandura (1977b) recommends that to maximise the effect of witnessing others on building self-efficacy, the model should have similar characteristics and circumstances to the observer, be seen to overcome difficult circumstances with determined efforts rather than ease, and be shown to have a rewarding outcome. Hence it is plausible that similarities among participants (being in ‘the same boat’) combined with pitching the programme at the right level (via tailoring and progression) embellished the effect of witnessing others upon self-efficacy.

In summary, findings of the present study suggest that the type of exercise (tailored, progressed, functional), exercising as a group, and the relatively high exercise dose (opportunities for practice), promoted self-efficacy. Interestingly, although the present study’s qualitative findings indicated increased self-efficacy, no significant between-group difference in the FES-I was detected. Possible explanations include, firstly, that while the FES-I has excellent validity and reliability (Delbaere et al., 2010; Kempen et al., 2008; Yardley et al., 2005), some authors have reported that it is skewed towards assessing persons with higher levels of concern about falling,

resulting in a floor effect (Cumming et al., 2000; Makai et al., 1991; Talley, Wyman, & C.R., 2008). For example, Arai et al. (2007) in investigating a similar population to the present study, found no significant between-group difference in the FES-I and hypothesised that their intervention had no apparent effect because their sample of community-dwelling older people had high baseline FES-I scores. In light of a possible floor effect, Delbaere et al. (2010) recommend that additional more demanding balance activities be explored. These authors contend that inclusion of such activities would increase ability of the FES-I to track the full range of concern about falling in healthy older adults. Furthermore, Arai et al. (2007) suggest the Activities Specific and Balance Confidence (ABC) Scale may have been more appropriate for use with their cohort. Similar to the FES-I, the ABC Balance Scale is based on the concept of self-efficacy. However, the ABC includes functional activities from a wider continuum of activity difficulty, than does the FES-I (Powell & Myers, 1995). So it is possible that the ABC scale may be more suited to use with some higher functioning community populations.

Third, because self-efficacy is situation specific (Bandura, 1997), fall related self-efficacy measures tend to be limited by the scope of mobility tasks or physical activities assessed (Fuzhong et al., 2002). Thus, it is possible that qualitative methods revealed changes in self-efficacy not detected by the FES-I. However, qualitative findings may have indicated changes in both self-efficacy and falls self-efficacy. The FES-I measures falls self-efficacy. Hence, changes in self-efficacy per se, while important, may not have greatly impacted the FES-I.

Yardley et al. (2006) hypothesise that programmes which emphasise balance improvement would be likely to increase confidence in balance with potential positive impacts on activity levels, physical functioning and fall risk factors. Liu-Ambrose et al. (Liu-Ambrose, Khan, Eng, Lord et al., 2004), in evaluating their study of women aged 75-85 years with low bone mass made the point that because fear of falling is a psychological entity and multifactorial in aetiology, a multidimensional approach such as combining an exercise intervention and fall education may have been more efficacious than exercise alone in enhancing balance confidence in their cohort. Moreover, studies by Clemson et al. (2004) and Tennstedt et al. (1998) provide some support for the use of a cognitive component in fall prevention interventions. Therefore further research across a range of settings is needed to determine the effectiveness of efficacy-building strategies in preventing falls and the effectiveness of combining efficacy building strategies with balance-training exercise to prevent falls.

While the present programme focused on functional indoor activities, the Cheal and Clemson (2001) 'Steady-As-You-Go' programme featured outdoor activities and excursions, and found

enhanced self-efficacy in outdoor fall risk situations. Hence future studies may benefit from including mastery experiences and skill building for both indoor and outdoor activities.

10.6.3 *Enhancing adherence*

To be of ongoing benefit, fall prevention exercise interventions must be sustained (Todd & Skelton, 2004). The present study explored participant experiences and views of the intervention to identify barriers and facilitators for participation.

The low drop out rate of 7.5% in the present study indicated that the exercise programme was acceptable and enjoyable. The median programme length was 12 weeks and median programme attendance was 10 weeks. Participants were requested to perform the home exercise programme three times per week for one year. They undertook the home exercises an average of three times per week for the first four months. Interestingly, the average weekly occasions of the home exercise declined steadily from the fourth month. This drop-off in adherence to the home programme correlated with cessation of the exercise classes. These quantitative findings lend support to the qualitative findings suggesting that ‘group exercise’ and the combined class-home programme format enhanced participation.

These difficulties with long term adherence, which are consistent with those reported by other fall prevention interventions (McInnes & Askie, 2004; Yardley, Bishop et al., 2006), suggest that programme sustainability needs to be reviewed and researched with further study. In particular, studies should aim to minimise drop-off in performance of the exercises by providing ongoing motivation once the initial phase is complete. For example, continued participation could be promoted by relatively low resource demand methods like telephone calls and booster sessions (Campbell et al., 1999a; Sjosten et al., 2007; Tennstedt et al., 1998). Moreover, studies which monitor participants over extended periods are likely to increase understanding about adherence (Marcus et al., 2000).

Previous studies have identified that poor health acts as a barrier to participation (McInnes & Askie, 2004; Yardley, Donovan-Hall et al., 2006). Although the definition of poor health is controversial, several demographic characteristics of the study sample could be considered reflective of poor health. Notably, of the RCT participants, 78% experienced four or more co-morbidities, around 60% took four or more medications, 50% had fallen at least once in the year prior to commencement of the study, and 46% rated their balance as fair or poor. Despite the extent of health issues, relatively good rates of compliance were recorded with the class and home programme. Thus, it is plausible that specific programme attributes facilitated adherence.

While previous fall prevention studies have not looked extensively at factors affecting adherence, they have shed some light on the topic. A review by McInnes and Askie (2004) found that adherence was boosted by exercises of low to moderate intensity and moderate frequency (McInnes & Askie, 2004). The present study supports these findings, in that the exercise programme was of low to moderate intensity and moderate frequency, and recorded relatively good rates of adherence. Moreover, the type of exercise by virtue of being functional, tailored and progressed helped address concerns about suitability and possible adverse consequence. The following section discusses each component.

Type of exercise

Poor health (e.g. co-morbidity, pain, mobility limitation) is a commonly cited barrier to participation. In particular, studies show that concern over the suitability of exercises for the individual and anxiety about the adverse consequences acted as barriers to participation (McInnes & Askie, 2004; Nolan, 2008; Yardley, Donovan-Hall et al., 2006). Moreover, unpleasant sensations associated with exercise can decrease motivation and self-efficacy (see Chapter 3 section 3.3.1) (Bandura, 1997; McAuley et al., 1993; Resnick & Spellbring, 2000).

Generic exercise studies have demonstrated that exercises tailored to the needs of an individual are associated with higher levels of adherence (Gavin & Meyers, 2003). Similarly, findings of the present study indicate that tailoring the exercises boosted adherence. Consistent with the findings of Yardley et al. (2006), the present study found that tailoring assisted the programme strike a balance of being simple enough not to overwhelm but challenging enough to maintain interest and produce improvement. These qualitative findings were supported by quantitative results. The majority (97%) of participants reported that the programme was easy or about right in terms of its level of difficulty. Notably, all participants indicated the programme had been of benefit.

Progressions were an important source of motivation for participants. Attaining goals demonstrated improvement, thereby motivating participants to try advanced versions of the exercise and continue in the programme. The intervention was based on functional exercises. Hence, participants perceived that carrying out the exercises would assist them to perform their everyday tasks and this motivated them to practice.

Group exercise

There is ongoing controversy surrounding levels of supervision required for optimal fall prevention (Chang et al., 2004) and whether interventions are best delivered on a group or

individual basis. The qualitative findings suggest several ways in which exercising in a group contributed to adherence. The group atmosphere made the exercises more enjoyable to perform. The 'safe' and supported atmosphere at classes played a role in boosting participant confidence and motivation. Being part of the group also generated a range of social benefits, which were strong motivators for adherence; to the extent that several participants confided that they simply would not have attended had it not been for the social aspect.

It is recognised that ongoing supervision plays an important role in maintaining adherence to exercise (Hillsdon et al., 1995). In the present study, participants were reassured and encouraged to know they were performing the exercises safely and correctly. Supervision also brought an element of accountability, participants were mindful that their progress, particularly on the home programme, would be monitored at classes. This motivated them to practice the home exercises.

An interesting finding was that the programme provided opportunities for competition between self and others. Tailoring and progressions permitted self-competition. Participants could improve their performance on a version of the exercise and progress to a higher level. Alternatively, the group situation provided opportunities for comparison and competition with others. Both forms of competition were reported as motivating. Hence, offering a tailored programme within a group setting increased opportunities for motivation through competition.

Delivery format

The use of a structured programme (weekly class and ancillary home programme) facilitated adherence. Participants found it beneficial to have a routine, something definite to undertake. The class and home programme each provided a source of motivation. Together they generated momentum which facilitated adherence.

The class required that participants set aside time to attend, and thereby assisted to complete the exercises. The home programme was user-friendly in that it was supported by a manual which reminded participants to perform the exercises and of how to perform them. All participants found the manual easy to follow and helpful. The home exercises were also convenient because they negated the need for travel and participants were able to fit the exercise around their everyday commitments. Overall, it is plausible that the user-friendly home programme promoted adherence.

Consistent with other research, participants saw it as important that the programme not be too onerous in terms of the time and effort required (Simpson et al., 2003; Vaapio et al., 2008;

Yardley, Donovan-Hall et al., 2006). The quantitative findings confirm that the time demands were acceptable. The majority of participants (96%) reported that the time required to commit to the programme was about right.

Programme components with respect to outcomes

Interpretation of the qualitative data indicates that a diverse range of benefits motivated ongoing participation in the programme. It is of interest that many of the identified programme benefits aligned closely with what older people have identified as important elements of successful ageing and QOL (increased physical and social function, control and independence). This link between the multiple positive benefits of fall prevention programmes and adherence has been observed in other fall prevention studies (Clemson et al., 2003; Yardley, Bishop et al., 2006).

Findings of the present study suggest that physiotherapists working in the field of fall prevention need to question the basis for the interventions and outcome measures they employ. Whereas fall prevention programmes have traditionally focused on evaluating physical parameters and rates of falls, older people may be better served by interventions that aim to not only reduce risk of falling but to promote independence and QOL. Moreover, careful consideration of programme design, so as to emphasise and maximise benefits in accordance with what older people consider important aspects of QOL, may be the key to enhancing adherence and ultimately preventing falls.

While findings of this research provide insights into a range of important programme components and outcomes, further research is required to tease out the components of fall prevention exercise programmes which maximise adherence and outcomes. Hence, it is recommended that process and broader outcomes be on the agenda for future studies of fall prevention exercise programmes. It is further suggested that assessment of these programmes may benefit from combining quantitative and qualitative methods to investigate physical and psychosocial outcomes, as this present study did.

10.6.4 Implementation

There is a paucity of evidence concerning rural fall prevention exercise programmes and their implementation. Close (2005b) emphasises that all professionals involved in the care of older people have a responsibility to apply fall prevention strategies for which there is good evidence. To assist in closing the gap between evidence and practice it is recommended that barriers to implementation in local contexts be addressed and overcome. The present study identified

several barriers and facilitators to programme delivery. These novel findings may assist the design of future rural fall prevention exercise interventions to achieve desired outcomes.

Barriers to implementation

The three main barriers to programme delivery were all related to the rural context. First, resources, especially time and equipment, were limited. Mainstream research acknowledges that the amount and type of available resources influence implementation. This is a particular problem in rural areas where there are frequently shortages of rural health professionals and practitioners are required to provide services across large geographical areas with limited resources (AIHW, 2008a; Bourke et al., 2004; NRHA, 2005).

Second, the physiotherapists perceived that limited experience in the field of fall prevention impacted their confidence to provide a programme. Mainstream literature on knowledge translation recognises that professionals may need to be trained and supported to incorporate evidence into their daily work (Grol & Wensing, 2004e; Leigh et al., 2004). Further, The National Institute of Clinical Excellence (2004b) and National Public Health Partnership publication 'National Falls Prevention for Older People: 2004 Onwards' (2004) contends that workforce training and development is an essential part of building and supporting the capacity of health professionals to reduce falls. This is a particular problem in rural areas because rural physiotherapists often work as 'specialist generalists', requiring them to have a breadth of knowledge across a wide range of services, while being expert in each service they deliver (Arthur et al., 2005; Sheppard, 2005). Yet their ability to provide these services is hampered by relative professional isolation, and difficulties accessing continuing education due to distance and cost (Curran et al., 2006; Dade Smith, 2004; Williams et al., 2007).

Third, the physiotherapists reported that obtaining management approval acted as a barrier to initiating a fall prevention intervention. In particular, limited experience and confidence in fall prevention and limited available time, impacted their ability and willingness to negotiate with management. This was consistent with the Leigh et al. (2004) finding that the clinician-administrator divides can impact on a clinician's ability to work for change.

Transport has been identified as a key rural health issue (Wakerman & Humphreys, 2002). In the present study transport was identified as a major barrier to participants accessing the programme. In the first instance, it is possible that geographical distance acted as a barrier to accessing class venues. While the catchment area for the study was large, around three-quarters of participants lived less than five kilometres from the class venues. In fact, only two participants lived 31 or more kilometres from the hub or spoke venue. As discussed earlier, the

class-home programme format offered many benefits. However, for persons residing at a considerable distance from the class venue, the requirement to attend a weekly class may have served as a barrier to participation. Research is needed to determine whether special modes of delivery are required for persons in these circumstances. For example, future research could investigate the use of telemedicine to deliver fall prevention exercise programmes (Matjacic et al., 2009).

In the second instance, limited transport was a barrier to access. This finding is consistent with those of metropolitan fall prevention programmes highlighting access to transport as a barrier to participation (Cheal & Clemson, 2001; Nitz & Choy, 2004). However, limited accessible transport is recognised as a particular issue in rural areas (Bourke et al., 2004; National Rural Health Alliance, 2004; Wakerman & Humphreys, 2002). Hence, it is recommended that future rural fall prevention research and clinical programmes give particular consideration to ensuring suitable transport is available to access venues. One option may be community transport, provided free or at subsidised rates to participants.

Facilitators to implementation

Analysis and interpretation revealed five main facilitators to implementation; the coordinator, packaged programme, professional network, volunteer assistants and requirement for minimal equipment. Interestingly, these facilitators are consistent with what Rogers (1983) identified as the five elements which can influence implementation.

Grol and Wensing (2004c) identified that a leader may bring expertise in the field and play a central role in communicating the aim and involving the target group. In the present study, the coordinator assisted implementation in several ways. Importantly, the coordinator had developed the programme, inclusive of all resources and ready for use. This saved the physiotherapists considerable time and effort. The therapists spoke of their limited experience in fall prevention and lack of confidence to deliver a programme. They perceived that provision of a prepared programme increased their confidence to deliver the intervention.

The physiotherapists found it helpful that the coordinator had liaised with management about the programme. The coordinator, by virtue of having experience in the field and time to devote, was considered well positioned to advocate for commencement of the programme. Findings highlighting the important role of the coordinator were similar to those of a rural South Australian fall prevention study (Brown, 2004). That study identified that it had been helpful to have had a 'champion', preferably of medical or allied health background, committed to the project and with time to devote to it. Similarly, Moore et al. (2008) in their review of Victorian

fall prevention programmes (2000-2007) identified the importance of a key driver, someone with an ongoing role to support fall prevention activities at a local level. Given the demographics of rural Australia, perhaps ‘experts’ could be responsible for a cluster of programmes in different locals.

As is common in implementation, the relationship between the coordinator and physiotherapists moved from a ‘hands on’ development role to a ‘hands off’ consultative relationship (NSW Health Department, 2001). The study identified three main means by which the implementation method countered professional isolation. First, the coordinator provided onsite training at the spoke sites. There is evidence that outreach visits offering tuition tailored to provider needs can assist implementation (Grol & Wensing, 2004b; Sanson-Fisher, 2004; Wensing et al., 2010). This reduced the time burden to the physiotherapists. It also boosted physiotherapist confidence to deliver the programme because therapists had seen it applied in their own setting.

Second, the coordinator provided ongoing support by phone and email, which maintained a sense of connection, but minimised the need for time away from work. Sheppard (2001) suggests that the development of flexible delivery education and support may assist in meeting individual rural clinician’s needs in a timely manner. Findings suggest that the present implementation method achieved flexible delivery, education and support via the site visit and telephone/email contact, all of which were scheduled to suit individual physiotherapist circumstances.

Third, the physiotherapist network also assisted programme delivery. The network provided an opportunity to ‘work together’ on a common programme, despite the geographical distances which separated physiotherapists. Similarly, McLeroy et al. (1988) found that implementation could occur through local networks. Interestingly, findings of the present study identifying the contribution of the coordinator, flexible delivery education, and the network are consistent with Schoo and colleagues’ (2005) suggestion that creating a professional network supported by the regional organisation of resources and infrastructure may help overcome difficulties associated with providing adequate professional development and support to rural practitioners.

The physiotherapists recounted that budget and time constraints typically limited practitioner access to additional equipment. They appreciated that the programme required little additional equipment and that any specific items they required were available for loan. This feature reduced the cost burden incurred by the physiotherapy department, augmented the programme’s versatility and assisted in gaining management approval. These findings are consistent with Yates and Dunnagan’s (Yates & Dunnagan, 2001) suggestion that for rural communities, which

most often lack health resources, low-cost is likely to be an important feature of successful fall prevention interventions.

The inclusion of volunteer assistants in programme delivery has been little reported in the literature. The present study highlights the valuable contribution volunteer assistants make to effective programme delivery. From the physiotherapists' perspective, volunteer assistants eased their burden and boosted confidence in delivering the programme. The majority of participants (98%) said they liked having volunteers assist at the classes. This result was supported by qualitative findings. Volunteer assistants were seen to make a particularly important contribution to promoting a positive group dynamic, and the provision of social support, supervision, feedback and encouragement.

This study employed a class-home programme format because it offered several advantages for use in a rural context. Some fall prevention interventions have been delivered exclusively within participants' homes (Campbell et al., 1997; Robertson, Devlin, Scuffham et al., 2001). However, rural health services are often required to cover large geographical distances with limited health resources. From the rural provider perspective, interventions based solely on home visits are likely to be time consuming and expensive. Some fall prevention exercise programmes have been delivered solely as group sessions (Barnett et al., 2003; Lord, Castell et al., 2003; Voukelatos et al., 2007). In the rural context limited resources in terms of physiotherapist's time and participant access to transport, are likely to impact the sustainability of this approach. The combined class-home programme format, in addition to being feasible for use in a rural context, produced benefits over and above those of the individual modes of delivery.

An important outcome was that the programme built capacity to provide future fall prevention exercise programmes. Findings identified capacity building strategies which spanned three main areas. The first area was organisational development or structure and addressed the clinician-administrator divide. The second area concerned resource allocation. Specifically, the need for exercise equipment was minimised and the prepared programme was provided as a resource (NSW Health Department, 2001). The third area was associated with workforce development. Physiotherapists gained experience and confidence in working with the programme. An additional benefit was that experience with the fall prevention programme built physiotherapist capacity to work with a range of other client groups. Therapists considered this of benefit in their role as specialist generalists.

Quantitative results showed the intervention was acceptable from the participant's perspective. The overwhelming majority (86%) said they would do the programme again, if it were offered. Physiotherapist and volunteer assistant comments indicated that programme delivery gave a sense of positive purpose to providers. All of the physiotherapists and the majority of volunteer assistants (94%) expressed an interest in providing future fall prevention programmes.

10.7 Conclusion

The prevention of falls among older persons is a national health promotion priority. Falls are a particular problem in rural Australia due to the marked ageing population and reduced access to health services. Research is needed to determine the fall prevention interventions and models of service delivery that will work effectively in rural communities. Balance-training is effective in reducing rates of falls in community-dwelling metropolitan older adults. No RCT with embedded qualitative study has investigated a balance-training exercise intervention to prevent falling among rural older Australians.

The present study assists our understanding of what works well, where and why (Humphreys et al., 2006) in relation to rural fall prevention exercise interventions. The primary aim of this study was to determine whether the balance-training programme would significantly reduce fall risk factors for community-dwelling rural older people. The programme produced significant between-group differences for both primary outcome measures (PPA composite score, Berg Balance Scale score) and several secondary outcome measures (average knee extensor strength, hand reaction time, sway on foam with eyes closed, choice stepping reaction time, and timed stand on one foot). There was also a between-group difference in the proportion of people who had one or more falls in the follow-up period, but this was not statistically significant. These quantitative results suggest that several programme components (tailored, progressed, functional balance-training exercise, and relatively high exercise dose) may have contributed to the effectiveness of the intervention.

The secondary purpose of the study was to shed light on the programme's process and outcomes. Findings suggest that improvements in physical parameters and self-efficacy combined to enhance function. These findings, consistent with those of Tinetti and colleagues' (1994), support their suggestion that fall prevention programmes should simultaneously attempt to improve physical skills and self-efficacy. Findings also linked several programme components with enhanced self-efficacy. First, it appears mastery experiences on functional tasks were an important aspect of the programme and central to building self-efficacy. Mastery

experiences led to increased functional ability and greater overall activity levels. Moreover, mastery experiences appear to have been promoted by the use of; tailored, progressive, functional exercise and the relatively high exercise dose (opportunities for practice).

Second, 'group exercise' generated positive affect and provided access to; 1) social support, 2) verbal persuasion, 3) supervision, feedback, encouragement and, 4) opportunities to witness others. Positive affect is a recommended strategy for building self-efficacy, so it is plausible that these factors contributed to enhanced self-efficacy. Third, the affective experience of the exercises, as well as the physical benefits such as, increased balance, strength and coordination, seemed to be an important means of building self-efficacy. In summary, findings of the present study suggest that fall prevention exercise programmes may benefit from the inclusion of components to build self-efficacy, in particular tailored, progressed, functional exercise, a relatively high exercise dose and a social aspect. However, further research is required to explore the effect of efficacy-building strategies across a range of settings.

Several authors have recommended the inclusion of a social component within fall prevention programmes (Ballinger & Clemson, 2006; Barlow et al., 1999; Bunn et al., 2008; McInnes & Askie, 2004; Yardley, Bishop et al., 2006). In the present study, the social aspect, additional to promoting self-efficacy, appears to have been a central factor in achieving a range of programme outcomes and good rates of adherence. Findings identified several advantages to the group situation. Group exercise made the exercises 'easier and lighter' to do, and thereby motivated participation. The group situation encouraged participants and provided social connection and support. Taken together, these findings suggest it may be beneficial to emphasise social aspects in the design and delivery of fall prevention exercise interventions.

The programme produced benefits beyond improvements in physical parameters and reduced risk of falling. It appeared to positively impact dimensions of QOL (physical function, social function and mental health) and provided a means by which participants could pursue their desire to maintain an active and independent lifestyle. These findings support the suggestion that programmes which look beyond preventing falls, to promote QOL and independence, may not only reduce the risk of falling but assist older people to age successfully in their terms, ultimately increasing adherence and decreasing costs to society. Interestingly, the associations participants made between the programme and promotion of independence are consistent with reports that older people welcome fall prevention exercise programmes because they see them as a means of maintaining control and independence (Commonwealth Department of Health and Aged Care, 2001; Stead et al., 1997; Yardley, Donovan-Hall et al., 2006).

The study recorded favourable rates of adherence with the classes and first three months of the home programme. This was assisted by pitching exercises to the needs of participants and ensuring exercises were not too onerous in terms of the time or effort required. Several means helped strike this balance. First, the tailored, progressed and functional components led the exercises to be challenging and beneficial, yet not overly demanding. Second, the class home programme format was convenient and acceptable, in terms of the time and effort required. The class and home programme each offered a source of motivation, and together provided momentum for continuing in the programme. Third, the use of a structured programme, something 'set and definite', assisted to 'get the exercises done'. Last, the programme outcomes (e.g. increased functional ability, social support and independence) were consistent with the goals of older people and motivated ongoing participation.

Despite several barriers, the programme was effectively implemented into a real-life rural context. Implementation was achieved via a hub-and-spoke model incorporating a number of facilitating features. The main facilitators were identified as; a coordinator to develop and drive the programme, a ready to use package which was low-cost and required minimal resources, and a professional network supported by volunteer assistants. The class-home programme format provided access to a relatively high dose of exercise, while minimising the time, travel and expense demands incurred by participants and the health service. The experience of providing the programme built the capacity of physiotherapists and volunteer assistants to provide future programmes. Good levels of acceptability were indicated by relatively high rates of adherence and an interest expressed by the majority of participants, volunteer assistants and physiotherapists to continue with the programme. However, transport was identified as a barrier to participation and is likely to be an important consideration in the design of future rural fall prevention programmes.

There are widely acknowledged difficulties in delivering rural health interventions and a dearth of rural fall prevention exercise trials. Findings of the present study underscore the value of using mixed methods designs to investigate fall prevention exercise interventions. This study contributes to the literature by providing an understanding of the process and outcomes of a rural fall prevention exercise programme. These findings may have implications for how future fall prevention exercise programmes are structured and implemented into rural clinical practice so as to maximise feasibility, adherence and outcomes. However, research across a range of rural communities is required to determine the most efficient and effective means of providing fall prevention exercise programmes for these populations.

In summary, the present study demonstrated that a safe and acceptable balance-training programme reduced risk factors for falls in community-dwelling rural older people of the upper Hunter New England region of NSW. These findings suggest that specifically designed balance-training programmes hold promise as a feasible and effective strategy for reducing fall risk factors and achieving additional benefits in the growing rural older population.

References

- Aamodt, A. M. (1982). Examining ethnography for nurse researchers. *Western Journal of Nursing Research*, 4(2), 209-220.
- Adamson, L., & Parker, G. (2006). 'There's more to life than just walking': Older women's ways of staying healthy and happy. *Journal of Aging and Physical Activity*, 14(4), 380-391.
- Addington-Hall, J., & Kalra, L. (2001). Measuring quality of life: Who should measure quality of life? *British Medical Journal*, 322(7299), 1417-1420.
- AGS Panel on Persistent Pain in Older Persons. (2002). The management of persistent pain in older persons. *Journal of the American Geriatrics Society*, 50(Suppl. 6), S205-224.
- Allan, J., Ball, P., & Alston, M. (2007). Developing sustainable models of rural health care: A community development approach [Electronic Version]. *Rural and Remote Health*, 7 December 2007, 1-8. Retrieved 12 January 2009 from <http://www.rrh.org.au/>.
- Allegre, J. P., & Marks, R. (2003). Self-efficacy in management of osteoarthritis. *Rheumatic Disease Clinics of North America*, 29(4), 747-768.
- American College of Rheumatology. (2000). Recommendations for the medical management of osteoarthritis of the hip and knee: 2000 update. American College of Rheumatology-Subcommittee on Osteoarthritis Guidelines. *Arthritis Rheumatism*, 43(9), 1905-1915.
- American College of Sports Medicine. (1998). American College of Sports Medicine Position Stand. Exercise and physical activity for older adults. *Medicine & Science in Sports & Exercise*, 30(6), 992-1008.
- American Council on Exercise. (1998). *Exercise for older adults: ACE's guide for fitness professionals*. Champaign, IL: Human Kinetics.
- American Geriatrics Society. (2001). Exercise prescription for older adults with osteoarthritis pain: Consensus practice recommendations. A supplement to the AGS clinical practice guidelines on the management of chronic pain in older adults. *Journal of the American Geriatrics Society*, 49(10), 808-823.
- American Geriatrics Society, British Geriatrics Society, & American Academy of Orthopaedic Surgeons Panel on Falls Prevention. (2001). Guidelines for the prevention of falls in older persons. *Journal of the American Geriatrics Society*, 49(5), 664-672.
- Andersen, B., Anderson, M., Forchhammer, J., Povlsen, J., & Topsoe-Jensen, H. (1988). *Elderly in motion*. Odense, Denmark: University of Odense.
- Anstey, K. J., Smith, G. A., & Lord, S. R. (1997). Test-retest reliability of a battery of sensory motor and psychological measures of aging. *Perceptual and Motor Skills*, 84(3 Pt. 1), 831-834.
- Arai, T., Obuchi, S., Inaba, Y., Nagasawa, H., Shiba, Y., Watanabe, S., et al. (2007). The effects of short-term exercise intervention on falls self-efficacy and the relationship between changes in physical function and falls self-efficacy in Japanese older people: A randomized controlled trial. *American Journal of Physical Medicine and Rehabilitation*, 86(2), 133-141.
- Arent, S. M., Landers, D. M., & Ettnier, J. L. (2000). The effects of exercise on mood in older adults: A meta-analytic review. *Journal of Aging and Physical Activity*, 8(4), 407-430.
- Arthur, L., Sheppard, L., & Dare, R. (2005). Redefining rural and remote physiotherapy practice. *Australian Journal of Rural Health*, 13(1), 57-57.

- Australian Bureau of Statistics. (2007). Population by age and sex, Australia, 2006. Cat.no.3235.0. Retrieved 30 July 2010, from <http://www.abs.gov.au/ausstats/>.
- Australian Bureau of Statistics. (2008a). Population projections Australia: 2006 to 2101. Cat.no.3222.0. Retrieved 29 June 2010, from <http://www.abs.gov.au/ausstats/>.
- Australian Bureau of Statistics. (2008b). Year book Australia, 2008. Cat.no.1301.0. Retrieved 17 July 2010, from <http://www.abs.gov.au/ausstats/>.
- Australian Government Department of Health and Ageing. (2001). *Measuring remoteness: Accessibility/Remoteness Index of Australia (ARIA) revised edition*: Occasional papers: New series number 14. Australian Government Department of Health and Ageing: Canberra, Australia. From <http://www.health.gov.au/internet/main/publishing.nsf/>.
- Australian Government Department of Health and Ageing. (2004). *Don't fall for it. Falls can be prevented! A guide to preventing falls for older people*: Number 3554/JN8817. State Government of South Australia: Adelaide, Australia.
- Australian Institute of Health and Welfare. (1998). *Health in rural and remote Australia*: Cat. no. PHE 6. Australian Institute of Health and Welfare: Canberra, Australia. From <http://www.aihw.gov.au/>.
- Australian Institute of Health and Welfare. (2000). *Physiotherapy labour force 1998*: National health labour force series. no. 22. Cat. no. HWL 22. Australian Institute of Health and Welfare: Canberra, Australia. From <http://www.aihw.gov.au/>.
- Australian Institute of Health and Welfare. (2004). *Rural, regional and remote health: A guide to remoteness classifications*: Cat. no. PHE 53. Australian Institute of Health and Welfare: Canberra, Australia. From <http://www.aihw.gov.au/>.
- Australian Institute of Health and Welfare. (2005b). *Rural, regional and remote health: Information, framework and indicators-Version 1b*: Rural health series. no. 6. Cat. no. PHE 69. Australian Institute of Health and Welfare: Canberra, Australia. From <http://www.aihw.gov.au/>.
- Australian Institute of Health and Welfare. (2007). *Older Australians at a glance: 4th edition*: Cat. no. AGE 52. Australian Institute of Health and Welfare: Canberra, Australia. From <http://www.aihw.gov.au/>.
- Australian Institute of Health and Welfare. (2008a). *Australia's health*: Cat.no. AUS 99. Australian Institute of Health and Welfare: Canberra, Australia. From <http://www.aihw.gov.au/>.
- Australian Institute of Health and Welfare. (2008b). *Rural, regional and remote health: Indicators of health status and determinants of health*: Rural health series no. 9. Cat. no. PHE 97. Australian Institute of Health and Welfare: Canberra, Australia. From <http://www.aihw.gov.au/>.
- Australian Institute of Health and Welfare. (2010). *Australia's health 2010*: Australia's health series no.12. Cat. no. AUS 122. Australian Institute of Health and Welfare: Canberra, Australia. From <http://www.aihw.gov.au/>.
- Ballinger, C., & Clemson, L. (2006). Older people's views about community falls prevention: An Australian perspective. *British Journal of Occupational Therapy*, 69(6), 263-270.
- Bandura, A. (1977a). Self-efficacy: Towards a unifying theory of behavioural change. *Psychological Review*, 84(2), 191-215.
- Bandura, A. (1977b). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37(2), 122-147.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

- Bandura, A. (1995). *Self-efficacy in changing societies*. Cambridge, England: Cambridge University Press.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: WH Freeman and Company.
- Bandura, A., Adams, N. E., & Beyer, J. (1977). Cognitive processes mediating behavioural change. *Personality and Social Psychology*, 35(3), 125-139.
- Barbour, R. S. (2001). Checklists for improving rigor in qualitative research: A case of the tail wagging the dog? *British Medical Journal*, 322 (7294), 1115-1117.
- Barlow, J. H., Williams, B., & Wright, C. C. (1999). Instilling the strength to fight the pain and get on with life: Learning to become an arthritis self-manager through an adult education programme. *Health Education Research*, 14(4), 533-544.
- Barnett, A., Smith, B., Lord, S. R., Williams, M., & Baumann, A. (2003). Community-based group exercise improves balance and reduces falls in at-risk older people: A randomised controlled trial. *Age & Ageing*, 32(4), 407-414.
- Barnett, C. J., & Smerdely, P. (2002). A comparison of community-based resistance exercise and flexibility exercise for seniors. *Australian Journal of Physiotherapy*, 48(3), 215-219.
- Bazeley, P. (2002). Issues in mixing qualitative and quantitative approaches to research. In R. Burber, J. Gardner & L. Richards (Eds.), *Applying qualitative methods to marketing management research*. London, UK: Palgrave MacMillan.
- Bazeley, P. (2003). Computerised data analysis for mixed methods research. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods for the social and behavioural sciences*. Thousand Oaks, CA: Sage Publications.
- Berg, K. O., Wood-Dauphinee, S. L., & Williams, J. I. (1995). The Balance Scale: Reliability assessment with elderly residents and patients with acute stroke. *Scandinavian Journal of Rehabilitation Medicine*, 27(1), 27-36.
- Berg, K. O., Wood-Dauphinee, S. L., Williams, J. I., & Gayton, D. (1989). Measuring balance in the elderly: Preliminary development of an instrument. *Physiotherapy Canada*, 41(6), 304-311.
- Berg, K. O., Wood-Dauphinee, S. L., Williams, J. I., & Maki, B. (1992). Measuring balance in the elderly: Validation of an instrument. *Canadian Journal of Public Health*, 83 (Suppl. 2), S7-11.
- Berg, S. (1996). Ageing, behaviour, and terminal decline. In J. E. Birren & Schaie (Eds.), *Handbook of the psychology of aging* (4th ed.). San Diego, CA: Academic Press.
- Bero, L. A., Grilli, R., Grimshaw, J. M., Harvey, E., Oxman, A. D., & Thompson, M. A. (1998). Closing the gap between research and practice: An overview of systematic reviews of interventions to promote the implementation of research findings. *British Medical Journal*, 317(7156), 465-568.
- Beswick, A. D., Rees, K., Dieppe, P., Ayis, S., Gooberman-Hill, R., Horwood, J., et al. (2008). Complex interventions to improve physical function and maintain independent living in elderly people: A systematic review and meta-analysis. *Lancet*, 371(9614), 725-735.
- Bhala, R. P., O'Donnell, J., & Thoppil, E. (1982). Ptophobia. Phobic fear of falling and its clinical management. *Physical Therapy*, 62(2), 187-190.
- Biddle, S. J. (2000). Emotion, mood and physical activity. In S. J. Biddle, K. R. Fox & S. H. Boutcher (Eds.), *Physical activity and psychological well-being*. Abingdon, UK: Routledge.
- Bloem, B. R., Steijns, J. A., & Smits-Engelsman, B. C. (2003). An update on falls. *Current Opinion in Neurology*, 16(1), 15-26.

- Blum, L., & Korner-Bitensky, N. (2008). Usefulness of the Berg Balance Scale in stroke rehabilitation: A systematic review. *Physical Therapy*, 88(5), 559-566.
- Bogdan, R. C., & Biklen, S. K. (1998). *Qualitative research for education* (3rd ed.). Needham Heights, MA: Allyn and Bacon.
- Bootsma-van der Weil, A., Gussekloo, J., de Craen, A. J., Van Exel, E., Bloem, B. R., & Westendorp, R. (2002). Common chronic diseases and general impairments as determinants of walking disability in oldest-old population. *Journal of the American Geriatrics Society*, 50(8), 1405-1410.
- Bouisset, S., & Zattara, M. (1987). Biomechanical study of the programming of anticipatory postural adjustments associated with voluntary movement. *Journal of Biomechanics*, 20(8), 735-742.
- Bourke, L., Sheridan, C., Russell, U., Jones, G., DeWitt, D., & Liaw, S. T. (2004). Developing a conceptual understanding of rural health practice. *Australian Journal of Rural Health*, 12(5), 181-186.
- Boutron, I., Moher, D., Altman, D. G., Schulz, K. F., Ravaud, P., & CONSORT Group. (2008). Methods and processes of the CONSORT Group: Example of an extension for trials assessing nonpharmacological treatments. *Annals of Internal Medicine*, 148(4), W60-66.
- Bowling, A. (1994). Social networks and social support among older people and implications for emotional well-being and psychiatric morbidity. *International Review of Psychiatry*, 6(1), 41-58.
- Bowling, A. (1995). What things are important in people's lives? A survey of the public's judgements to inform scales of health related quality of life. *Social Science and Medicine*, 41(10), 1447-1462.
- Bowling, A. (2005). *Ageing well: Quality of life in older age*. Maidenhead, UK: Open University Press.
- Bowling, A., Gabriel, Z., Dykes, J., Dowding, L. M., Evans, O., Fleissig, A., et al. (2003). Let's ask them: A national survey of definitions of quality of life and its enhancement among people aged 65 and over. *International Journal of Ageing and Human Development*, 56(4), 269-306.
- Bowling, A., & Grundy, E. (1998). The association between social networks and mortality in later life. *Review in Clinical Gerontology*, 8(4), 353-361.
- Bowling, A., & Liffé, S. (2006). Which model of successful ageing should be used? Baseline findings from a British longitudinal survey of ageing. *Age and Ageing*, 35(6), 607-614.
- Bowling, A., Seetai, S., & Morris, R. (2007). Quality of life among older people with poor functioning. The influence of perceived control over life. *Age and Ageing*, 36(3), 310-315.
- Bradham, D. D. (1994). Outcomes research in orthopaedics: History, perspectives, concepts, and future. *Arthroscopy: The Journal of Arthroscopic and Related Surgery*, 10(5), 493-501.
- Bradley, C., & Harrison, J. E. (2007). *Hospitalisations due to falls in older people, Australia, 2003-04: Injury research and statistics series no. 32*. Cat. no. INJCAT 96. Australian Institute of Health and Welfare: Adelaide, Australia: From <http://www.aihw.gov.au/>.
- Britten, N. (2006). Qualitative interviews. In C. Pope & N. Mays (Eds.), *Qualitative research in health care* (3rd ed.). Malden, MA: Blackwell Publishing.
- Brown, D. S. (2004). Do leaves have to fall in their Autumn? A falls prevention strategy in action in the south east of South Australia [Electronic Version]. *The International Electronic Journal of Rural and Remote Health Research*,

- Education, Practice and Policy*, 4, 1-9. Retrieved 18 February 2005 from <http://www.rrh.org.au/>.
- Browne, J. (2004). Grounded theory analysis: Coming to data with questioning minds. In V. Minichiello, G. Sullivan, K. Greenwood & R. Axford (Eds.), *Research methods for nursing and health sciences* (2nd ed.). Sydney, Australia: Pearson Education Australia.
- Bruce, D. G., Devine, A., & Prince, R. L. (2002). Recreational physical activity levels in healthy older women: The importance of fear of falling. *Journal of the American Geriatrics Society*, 50(1), 84-89.
- Brukner, P., & Khan, K. (2007). *Clinical sports medicine*. Sydney, Australia: McGraw-Hill.
- Buchan, H., Sewell, J. R., & Sweet, M. (2004). Translating evidence into practice. *Medical Journal of Australia*, 180 (Suppl 6.), S43-44.
- Buchner, D. M., Beresford, S. A., Larson, E. B., LaCroix, A. Z., & Wagner, E. H. (1992). Effects of physical activity on health status in older adults. *Annual Review of Public Health*, 13, 469-488.
- Buchner, D. M., Cress, M. E., de Lateur, B. J., Esselman, P. C., Margherita, A. J., Price, K., et al. (1997). The effect of strength and endurance training on gait, balance, fall risk, and health service use in community-living older adults. *Journals of Gerontology. Series A, Biological Sciences & Medical Sciences*, 52A(4), M218-224.
- Bunn, F., Dickinson, M., Barnett-Page, E., McInnes, E., & Horton, K. (2008). A systematic review of older people's perceptions of facilitators and barriers to participation in falls-prevention interventions. *Age and Ageing*, 28, 449-472.
- Campbell, A. J., Reinken, J., Allan, B. C., & Martinez, G. S. (1981). Falls in old age: A study of frequency and related clinical factors. *Age & Ageing*, 10(4), 264-270.
- Campbell, A. J., & Robertson, M. C. (2007). Rethinking individual and community fall prevention strategies: A meta-regression comparing single and multifactorial interventions. *Age and Ageing*, 36(6), 656-662.
- Campbell, A. J., Robertson, M. C., Gardner, M. M., Norton, R. N., & Buchner, D. M. (1999a). Falls prevention over 2 years: A randomized controlled trial in women 80 years and older. *Age & Ageing*, 28(6), 513-518.
- Campbell, A. J., Robertson, M. C., Gardner, M. M., Norton, R. N., & Buchner, D. M. (1999b). Psychotropic medication withdrawal and a home-based exercise program to prevent falls: A randomized controlled trial. *Journal of the American Geriatrics Society*, 47(7), 850-853.
- Campbell, A. J., Robertson, M. C., Gardner, M. M., Norton, R. N., Tilyard, M. W., & Buchner, D. M. (1997). Randomised controlled trial of a general practice programme of home based exercise to prevent falls in elderly women. *British Medical Journal*, 315(7115), 1065-1069.
- Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Boston, MA: Houghton Mifflin Company.
- Carr, J., & Shepherd, R. (1998). *Neurological rehabilitation: Optimizing motor performance*. Bath, UK: Butterworth-Heinemann.
- Carter, N. D., Kannus, P., & Khan, K. M. (2001). Exercise in the prevention of falls in older people: A systematic literature review examining the rationale and the evidence. *Sports Medicine*, 31, 427-438.
- Casteel, C., Peek-Asa, C., Lacsamana, C., Vazquez, L., & Kraus, J. F. (2004). Evaluation of a falls prevention program for independent elderly. *American Journal of Health Behavior* 28(Suppl. 1), S51-60.

- Chang, J. T., & Ganz, D. (2007). Quality indicators for falls and mobility problems in vulnerable elders. *Journal of the American Geriatrics Society*, 55(Suppl 2), S327-334.
- Chang, J. T., Morton, S. C., Rubenstein, L. Z., Mojica, W. A., Maglione, M., Suttrop, M. J., et al. (2004). Interventions for the prevention of falls in older adults: Systematic review and meta-analysis of randomised clinical trials. [Electronic Version]. *British Medical Journal*, 328, 680. Retrieved 20 March 2005 from <http://www.bmj.com/>.
- Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research*. Thousand Oaks, CA: Sage Publications.
- Charmaz, K. (2006). *Constructing grounded theory. A practical guide through qualitative analysis*. London, UK: Sage Publications.
- Cheal, B., & Clemson, L. (2001). Older people enhancing self-efficacy in fall-risk situations. *Australian Occupational Therapy Journal*, 48(2), 80-91.
- Chenoweth, L. (2004). Educating practitioners for integrative rural practice. *Rural Society*, 14(3), 276-287.
- Clark, D. O. (1999). Identifying psychological, physiological, and environmental barriers and facilitators to exercise among older low income adults. *Journal of Geropsychology*, 5(1), 51-62.
- Clemson, L., Cumming, R. G., Kendig, H., Swann, M., Heard, R., & Taylor, K. (2004). The effectiveness of a community-based program for reducing the incidence of falls in the elderly: A randomised controlled trial. *Journal of the American Geriatrics Society*, 52(9), 1487-1494.
- Clemson, L., Swann, M., Twible, R., Cumming, R. G., Kendig, H., & Taylor, K. (2003). *Stepping on: Building confidence and reducing falls. A community-based program for older people*. Sydney, Australia: The University of Sydney.
- Close, J. C. (2005a). Prevention of falls-A time to translate evidence into practice. *Age and Ageing*, 34(2), 98-100.
- Close, J. C. (2005b). Prevention of falls in older people. *Disability and Rehabilitation*, 27(18-19), 1061-1071.
- Close, J. C. (2006). The falls epidemic-a geriatrician's perspective. *Journal of Science and Medicine in Sport*, 9(4), 350-351.
- Close, J. C., Ellis, M., Hooper, R., Glucksman, E., Jackson, S., & Swift, C. (1999). Prevention of falls in the elderly trial (PROFET): A randomised controlled trial. *The Lancet*, 353(9147), 93-97.
- Close, J. C., Lord, S. R., Menz, H. B., & Sherrington, C. (2005). What is the role of falls? *Best Practice and Research in Clinical Rheumatology*, 19(6), 913-935.
- Close, J. C., McMurdo, M. E., & British Geriatrics Society Falls and Bone Health Section. (2003). Falls and bone health services for older people. *Age and Ageing*, 32(5), 494-496.
- Cockburn, J. (2004). Adoption of evidence into practice: Can change be sustainable. *Medical Journal of Australia*, 180(Suppl 6), S66-67.
- Commonwealth Department of Health and Aged Care. (2001). *National Falls Prevention for Older People Initiative 'Step out with confidence'*. Commonwealth Department of Health and Aged Care: Canberra, Australia.
- Commonwealth Department of Health and Aged Care [Marketing Consultancy Network Inc]. (2000). *Managing innovation. A study into the information needs and perceptions of older Australians concerning falls and their prevention*. Commonwealth Department of Health and Aged Care: Canberra, Australia.

- Commonwealth Department of Primary Industries and Energy (DPIE), & Commonwealth Department of Human Services and Health (DHS). (1994). *Rural, remote and metropolitan zones classification: 1991 Census edition*: DPIE and DHS: Canberra, Australia. From <http://www.pc.gov.au/data/assets/>.
- Costello, P. H. (2002). *Budget paper No. 5: The intergenerational report 2002-2003*: Commonwealth of Australia: Canberra, Australia.
- Craft, L. L., & Landers, D. M. (Journal). The effects of exercise on clinical depression and depression resulting from mental illness: A meta-analysis. *Journal of Sport and Exercise Psychology*, 20(4), 339-357.
- Creswell, J., Plano Clark, V. L., Gutmann, M. L., & Hanson, W. E. (2003). Advanced mixed methods research designs. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural research*. Thousand Oaks, CA: Sage Publications.
- Creswell, J. W. (1998). *Qualitative enquiry and research design*. Thousand Oaks, CA: Sage Publications.
- Creswell, J. W. (2003). *Research design* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage Publications.
- Csuka, M., & McCarty, D. J. (1985). A simple method for measurement of lower extremity muscle strength. *American Journal of Medicine*, 78(1), 77-81.
- Cumming, R. G., Salked, G., Thomas, M., & George, S. (2000). Prospective study of the impact of fear of falling on activities of daily living, SF-36 scores, and nursing home admission. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 55A, M299-305.
- Curran, V. R., Fleet, L., & Kirby, F. (2006). Facilitators influencing rural health care professionals' access to continuing professional education. *Australian Journal of Rural Health*, 14(2), 51-55.
- Dade Smith, J. (2004). *Australia's rural and remote health*. Melbourne, Australia: Tertiary Press.
- Day, L., Fildes, B., Gordon, I., Fitzharris, M., Flamer, H., & Lord, S. (2002). Randomised factorial trial of falls prevention among older people living in their own homes [Electronic Version]. *British Medical Journal*, 325, 128. Retrieved 20 July 2005 from <http://www.bmj.com/>.
- Day, L., Finch, C., Harrison, J. E., Segal, L., Boufous, S., Hoareau, E., et al. (2006). Beyond the randomised controlled trial: Modelling the population level impact of proven falls initiatives for older people. In *3rd Australian and New Zealand Falls Prevention Conference* (pp. 16-16). Melbourne, Victoria: The Australian and New Zealand Falls Prevention Society.
- de Vaus, D. (1999). Structured questionnaires and interviews. In V. Minichiello, G. Sullivan, K. Greenwood & R. Axford (Eds.), *Handbook of research methods in health sciences* (2nd ed.). Sydney, Australia: Pearson Education Australia.
- Delbaere, K., Close, J. C., Mikolaizak, A. S., Sachdev, P. S., Brodaty, H., & Lord, S. R. (2010). The Falls Efficacy Scale International (FES-I). A comprehensive longitudinal validation study. *Age and Ageing*, 39(2), 210-216.
- Delbaere, M., Crombez, G., Vanderstraeten, G., Willems, T., & Cambier, D. (2004). Fear-related avoidance of activities, falls, and physical frailty. A prospective community-based cohort study. *Age and Ageing*, 33(4), 368-373.
- Denzin, N. K. (1978b). *The research act: A theoretical introduction to sociological methods* (2nd ed.). New York, NY: McGraw-Hill.

- Denzin, N. K. (1989). *The research act: A theoretical introduction to sociological methods* (3rd ed.). Englewood Cliffs, NJ: Prentice Hall.
- Department of Health and Human Services. (2005). *Focus on falls: Needs assessment for fall injury prevention for older people in Tasmania*: Department of Health and Human Services: Hobart, Australia.
- Department of Health Physical Activity Health Improvement and Prevention. (2004). *At least five a week: Evidence on the impact of physical activity and its relationship to health*: RORC Ref 2389. The Department of Health, Physical Activity, Health Improvement and Prevention: London, UK. From http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4080994.
- DePoy, E., & Gitlin, L. N. (2005). *Introduction to research: Understanding and applying multiple strategies* (3rd ed.). St Louis, MO: Elsevier Mosby.
- Devereux, K., Robertson, D., & Briffia, N. K. (2005). Effects of a water based program on women 65 years and over: A randomised controlled trial. *Australian Journal of Physiotherapy*, 51(2), 102-108.
- Dishman, R. K. (1994). Motivating older adults to exercise. *Southern Medical Journal*, 87(5), S79-82.
- Dishman, R. K., & Buckworth, J. (1996). Increasing physical activity: A quantitative synthesis. *Medicine and Science in Sports and Exercise*, 28(6), 706-719.
- Dolinis, J., Harrison, J. E., & Andrews, G. R. (1997). Factors associated with falling in older Adelaide residents. *Australian and New Zealand Journal of Public Health*, 21(5), 462-468.
- Domholdt, E. (2005). *Rehabilitation research: Principals and applications* (3rd ed.). St. Louis, MO: Elsevier Saunders.
- Draper, J. (2004). The relationship between research question and research design. In P. A. Crookes & S. Davies (Eds.), *Research into practice: Essential skills for reading and applying research in nursing and health care* (2nd ed.). Edinburgh, UK: Bailliere Tindall.
- Elavsky, S., McAuley, E., Motl, R. W., Knopack, J. F., Marquez, D. X., Hu, L., et al. (2005). Physical activity enhances long-term quality of life in older adults: Efficacy, esteem, and affective influences. *Annals of Behavioral Medicine*, 30(2), 138-145.
- Elley, C. R. (2008). Trials and tribulations of a multifactorial intervention through general practice. In *3rd Australian and New Zealand Falls Prevention Conference* (pp. 14-14). Melbourne, Australia: The Australian and New Zealand Falls Prevention Society.
- Elley, C. R., Robertson, M. C., Garrett, S., McKinlay, E., Kerse, N. M., Campbell, A. J., et al. (2006). Targeted multi-factorial falls prevention in general practice: First year of a randomized controlled trial. In *2nd Australian Falls Prevention Conference* (pp. 62-62). Brisbane, Australia: Queensland University of Technology.
- Ewart, C. K., Taylor, C. B., Reese, L. B., & DeBusk, R. F. (1983). Effects of early postmyocardial infarction exercise testing on self-perception and subsequent physical activity. *American Journal of Cardiology*, 51(7), 1076.
- Farquhar, M. (1995a). Definitions of quality-of-life: A taxonomy. *Journal of Advanced Nursing*, 22(3), 502-508.
- Farquhar, M. (1995b). Elderly people's definitions of quality of life. *Social Science and Medicine*, 41(10), 1439-1446.

- Feder, G., Cryer, C., Donovan, S., Carter, Y., & The Guidelines Development Group. (2000). Guidelines for the prevention of falls in people over 65. *British Medical Journal*, 321(7267), 1007-1011.
- Felton, B. J., & Berry, C. A. (1992). Do the sources of urban elderly's social support determine its psychological consequences? *Psychology and Aging*, 7(1), 89-97.
- Fitzgerald, K., Hornsby, D., & Hudson, D. (2000). A study of allied health professionals in rural and remote Australia [Electronic Version]. Retrieved 12 November 2006 from <http://www.ruralhealth.org.au/>.
- Fleiss, J. (1986). *The design and analysis of clinical experiments*. New York, NY: John Wiley and Sons.
- Flick, U. (2006). *An introduction to qualitative research* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Folkman, S., Lazarus, R. S., Gruen, R. J., & DeLongis, A. (1986). Appraisal, coping, health status, and psychological symptoms. *Journal of Personality and Social Psychology*, 50(3), 571-579.
- Forthofer, M. S. (2003). Status of mixed methods in the health sciences. In A. Tashakkori & C. B. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural sciences*. Thousand Oaks, CA: Sage Publications.
- Fortinsky, R. H., Iannuzzi-Sucich, M., Baker, D. I., Gottschalk, M., King, M. B., Brown, C. J., et al. (2004). Fall risk assessment and management in clinical practice: Views from healthcare providers. *Journal of the American Geriatrics Society*, 52(9), 1522-1526.
- Fraser, C., Judd, F., Jackson, H., Murray, G., Humphreys, J., & Hodgins, G. A. (2002). Does one size really fit all? Why the mental health of rural Australians requires further research. *The Australian Journal of Rural Health*, 10(16), 288-295.
- Fukukawa, Y., Kozakai, R., Niino, N., Nishita, Y., Ando, F., & Shimokata, H. (2008). Social support as a moderator in a fall prevention program for older adults. *Journal of Gerontological Nursing*, 34(5), 19-25.
- Fuzhong, L., McAuley, E., Fisher, K. J., Harmer, P., Chaumeton, N., & Wilson, N. L. (2002). Self-efficacy as a mediator between fear of falling and functional ability in the elderly. *Journal of Aging and Health*, 14(4), 452-466.
- Gates, S., Fisher, J. D., Cooke, M. W., Carter, Y. H., & Lamb, S. E. (2008). Multifactorial assessment and targeted intervention for preventing falls and injuries among older people in community and emergency care settings: Systematic review and meta-analysis. *British Medical Journal*, 336(7636), 130-133.
- Gavin, T. S., & Meyers, A. M. (2003). Characteristics, enrolment, attendance, and dropout patterns of older adults in beginner Tai-Chi and line-dancing programs. *Journal of Aging and Physical Activity*, 11(1), 123-141.
- Gill, D. L., Williams, K., Williams, L., & Hale, W. A. (1998). Multidimensional correlates of falls in older women. *Internal Journal of Aging and Human Development*, 47(1), 35-51.
- Gillespie, L. D. (2004). Preventing falls in elderly people. *British Medical Journal*, 328(7441), 653-654.
- Gillespie, L. D., Gillespie, W. J., Robertson, M. C., Lamb, S. E., Cumming, R. G., & Rowe, B. H. (2003). *Interventions for preventing falls in elderly people*: The Cochrane Database of Systematic Reviews. Issue 4. Art. No.:CD000340. DOI: 10.1002/14651858. From <http://cochrane.org/reviews/>.
- Gillespie, L. D., Robertson, M. C., Gillespie, W. J., Lamb, S. E., Gates, S., Cumming, R. G., et al. (2009). *Interventions for preventing falls in older people living in*

- the community*: Cochrane Database of Systematic Reviews. Issue 2. Art. No.: CD007146. pub2. DOI: 10.1002/14651858. From <http://cochrane.org/reviews/>.
- Glass, T. A., de Leomn, C. M., Marottoli, R. A., & Berkman, L. F. (1999). Population based study of social and productive activities as predictors of survival among elderly Americans. *British Medical Journal*, 319(7208), 478-483.
- Glasser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago, IL: Aldine.
- Gordon, N. F., Gulanick, M., Costa, F., Flectcher, G., Franklin, B. A., Roth, E. J., et al. (2004). Physical activity and exercise recommendations for stroke survivors: An American Heart Association scientific statement from the Council on Clinical Cardiology-Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention; the Council on Cardiovascular Nursing; the Council on Nutrition, Physical Activity, and Metabolism; and the Stroke Council. *Circulation*, 109(16), 2031-2041.
- Grbich, C. (1999). *Qualitative research in health: An introduction*. Sydney, Australia: Allen & Unwin.
- Greene, J. C., & Caracelli, V. C. (2003). Making pragmatic sense of mixed methods practice. In A. Tashakkori & C. B. Teddlie (Eds.), *Handbook of mixed methods in the social and behavioural sciences*. Thousand Oaks, CA: Sage Publications.
- Gregory, A. T., Armstrong, R. M., & Van Der Wyden, M. B. (2006). Rural and remote health in Australia: How to avert the deepening health care drought. *Medical Journal of Australia*, 185(11-12), 654-660.
- Grimshaw, J. M., & Eccles, M. P. (2004). Is evidence-based implementation of evidence-based care possible? *Medical Journal of Australia*, 180 (Suppl 6), S50-51.
- Grimshaw, J. M., Shirran, L., Thomas, R., Mowatt, G., Fraser, C., Bero, L., et al. (2001). Changing provider behavior: An overview of systematic reviews of interventions. *Medical Care*, 39(8, Suppl. 2), I12-I45.
- Grol, R. (1997). Beliefs and evidence in changing clinical practice. *British Medical Journal*, 315(7105), 418-421.
- Grol, R., & Grimshaw, J. M. (1999). Evidence-based implementation of evidence - based medicine. *Joint Commission Journal on Quality Improvement*, 25(10), 503-513.
- Grol, R., & Wensing, M. (2004a). Characteristics of successful innovations. In R. Grol, M. Wensing & M. P. Eccles (Eds.), *Improving patient care: The implementation of change in clinical practice*. Oxford, UK: Elsevier Science.
- Grol, R., & Wensing, M. (2004b). Dissemination of innovations. In R. Grol, M. Wensing & M. P. Eccles (Eds.), *Improving patient care: The implementation of change in clinical practice*. Oxford, UK: Elsevier Science.
- Grol, R., & Wensing, M. (2004c). Effective implementation: A model. In R. Grol, M. Wensing & M. P. Eccles (Eds.), *Improving patient care: The implementation of change in clinical practice*. Oxford, UK: Elsevier Science.
- Grol, R., & Wensing, M. (2004d). Selection of strategies. In R. Grol, M. Wensing & M. P. Eccles (Eds.), *Improving patient care: The implementation of change in clinical practice*. Oxford, UK: Elsevier Science.
- Grol, R., & Wensing, M. (2004e). What drives change? Barriers to and incentives for achieving evidence-based practice. *Medical Journal of Australia*, 180 (Suppl. 6), S57-60.

- Grossman, M. D., & Stewart, A. L. (2003). 'You aren't going to get better by just sitting around.' Physical activity perceptions, motivations, and barriers in adults 75 years of age or older. *American Journal of Geriatric Cardiology*, 12(1), 33-37.
- Guralnick, J. M., Ferrucci, L., Pieper, C. F., Leveille, S. G., Markides, K. S., Ostir, G. V., et al. (2000). Lower extremity function and subsequent disability: Consistency across studies, predictive models and value of gait speed alone compared with the short physical performance battery. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 55A(4), M221-231.
- Guralnick, J. M., Ferrucci, L., Simonsick, E. M., Salivc, M. E., & Wallace, R. B. (1995). Lower-extremity function in persons over the age of 70 years as a predictor of subsequent disability. *The New England Journal of Medicine*, 332(9), 556-561.
- Guralnick, J. M., Simonsick, E. M., Ferrucci, L., Glynn, R. J., Berkman, L. F., Blazer, D. G., et al. (1994). A short physical performance battery assessing lower limb extremity function: Association with self-reported disability and prediction of nursing home mortality. *Journal of Gerontology*, 49(2), 85-94.
- Hagen, K. B., Hilde, G., Jamtvedt, G., & Winnem, M. F. (2002). The Cochrane review of advice to stay active as a single treatment for low back pain and sciatica. *Spine*, 27(16), 1736-1741.
- Hardcastle, S., & Taylor, A. H. (2001). Looking for more than weight loss and fitness gain: Psychosocial dimensions among older women in a primary health care exercise referral scheme. *Journal of Aging and Physical Activity*, 9(3), 313-328.
- Harrison, M. B., Legare, F., Graham, I. D., & Fervers, B. (2010). Adapting clinical practice guidelines to local context and assessing barriers to their use. *Canadian Medical Association Journal*, 182(2), E78-84.
- Hass, B. K. (1999). A multidisciplinary concept analysis of quality of life. *Western Journal of Nursing Research*, 21(6), 728-742.
- Hatch, J., Gill-Body, K. M., & Portney, L. G. (2003). Determinants of balance confidence in community-dwelling elderly people. *Physical Therapy*, 83(12), 452-466.
- Hawe, P., Noort, M., King, L., & Jordens, C. (1997). Multiplying health gains: The critical role of capacity-building within health promotion programs. *Health Policy*, 39(1), 29-42.
- Hay, I. (2005). *Qualitative research methods in human geography* (2nd ed.). Melbourne, Victoria: Oxford University Press.
- Haywood, K. L., Garratt, A. M., & Fitzpatrick, R. (2005). Quality of life in older people: A structured review of generic self-assessed health instruments. *Quality of Life Research*, 14(7), 1651-1668.
- Heikkinen, R. L. (1998). *Growing older. Staying well. Aging and physical activity in everyday life*: WHO/HPR/AHE/98.1. World Health Organisation: Geneva, Switzerland. From <http://whqlibdoc.who.int/>.
- Hendry, F., & McVittie, C. (2004). Is quality of life a healthy concept? Measuring and understanding life experiences of older people. *Qualitative Health Research*, 14(7), 961-975.
- Henwood, K., & Pidgeon, N. (2003). Qualitative research in psychology. In P. M. Camic, J. E. Rhodes & L. Yardley (Eds.), *Qualitative research in psychology: Expanding perspectives in methodology and design*. Washington, D.C: American Psychological Association.
- Herrington, A., & Herrington, J. (2006). *Effective use of the internet - Keeping professionals working in rural Australia*: Code 05-171. Australian Government

- Rural Industries Research and Development Corporation: Canberra, Australia.
From <https://rirdc.infoservices.com.au/>.
- Herwaldt, L. A., & Pottinger, J. M. (2003). Preventing falls in the elderly. *Journal of the American Geriatrics Society*, 51(8), 1175-1177.
- Higginson, I. J., & Carr, A. J. (2001). Measuring quality of life: Using quality of life measures in the clinical setting. *British Medical Journal*, 322(7297), 1297-1300.
- Hill, K. D., Schwarz, J. A., Kalogeropoulos, A. J., & Gibson, S. J. (1996). Fear of falling revisited. *Archives of Physical Medicine & Rehabilitation*, 77(10), 1026-1028.
- Hillsdon, M., Thorogood, M., Anstiss, T., & Morris, J. (1995). Randomised controlled trials of physical activity promotion in free living populations: A review. *Journal of Epidemiology and Community Health*, 49(5), 448-453.
- Hirvensalo, M., Rantanen, T., & Heikkinen, E. (2000). Mobility difficulties and physical activity as predictors of mortality and loss of independence in the community-living older population. *Journal of the American Geriatrics Society*, 48(5), 493-498.
- Horsburgh, D. (2003). Evaluation of qualitative research. *The Journal of Clinical Nursing*, 12(2), 307-312.
- Hraba, J., Lorenz, F. O., & Pechacova, Z. (1997). Age and depression in the post-communist Czech republic. *Research on Aging*, 19(4), 442-461.
- Hughes, K., Van Beurden, E., Eakin, E. G., Barnett, L. M., Patterson, E., Backhouse, J., et al. (2008). Older persons' perception of risk of falling: Implications for fall-prevention campaigns. *American Journal of Public Health*, 98(2), 351-356.
- Hulley, S., Cummings, S., Browner, W. S., Grady, G. D., & Newman, T. B. (2007). *Designing clinical research* (3rd ed.). Philadelphia, PA: Lippincott Williams & Wilkins.
- Humphreys, J. (2002). Health service models in rural and remote Australia. In D. Wilkinson & I. Blue (Eds.), *The new rural health*. Melbourne, Australia: Oxford University Press.
- Humphreys, J. S., Wakerman, J., & Wells, R. (2006). What do we mean by sustainable rural health services? Implications for rural health research. *Australian Journal of Rural Health*, 14(1), 33-35.
- Hunter New England Area Health Service. (2005). Facts and figures. Retrieved 5 February 2011, from <http://www.hnehealth.nsw.gov.au/>.
- Hussain, R., Marino, R., & Coulson, I. (2005). The role of health promotion in healthy aging. In V. Minichiello & I. Coulson (Eds.), *Contemporary issues in gerontology: Promoting positive aging*. Sydney, Australia: Allen and Unwin.
- Imms, F. J., & Edholm, O. G. (1981). Studies of gait and mobility in the elderly. *Age and Ageing*, 10(3), 147-156.
- Ishii-Kuntz, M. (1990). Social contact and psychological well-being: Comparison across stages of adulthood. *International Journal of Ageing and Human Development*, 30(1), 15-36.
- Iso-Ahola, S. E., & Park, C. J. (1996). Leisure-related social support and self-determination as buffers of stress-illness relationship. *Journal of Leisure Research*, 28(3), 381-399.
- Johansson, C. (2003). Rising with the fall: Addressing quality of life in physical frailty. *Topics in Geriatric Rehabilitation*, 19(4), 239-248.
- Johnson, B. R., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.

- Jones-Roberts, M. A. (1998). *A model for the effective delivery of education and training services to rural and remote physiotherapists*. Melbourne, Australia: Australian Physiotherapy Association.
- Jones, D. A., Rutherford, O. M., & Parker, D. F. (1989). Physiological changes in skeletal muscle as a result of strength training. *Quarterly Journal of Experimental Physiology*, 74(3), 233-256.
- Jones, P. (2008). Access, equity and support for rural health professionals. In S. Liaw & S. Kilpatrick (Eds.), *A textbook of Australian rural health*. Canberra, Australia: Australian Rural Health Education Network.
- Jorstad, E. C., Hauer, K., Becker, C., & Lamb, S. E. (2005). Measuring the psychological outcomes of falling : A systematic review. *Journal of the American Geriatrics Society*, 53(3), 501-510.
- Joyce, A. (2002). *Promoting the social well-being of older people*. Unpublished doctoral dissertation. La Trobe University, Melbourne, Australia.
- Kaplan, G. A., Salonen, J. T., R.D., C., Brand, R. J., Syme, S. L., & Puska, P. (1988). Social connections and mortality from all causes and from cardiovascular disease: Prospective evidence from eastern Finland. *American Journal of Epidemiology*, 128(2), 370-380.
- Kelle, U. (2005). 'Emergence' vs. 'forcing' of empirical data? A crucial problem of 'Grounded Theory' reconsidered [Electronic Version]. *Qualitative Social Research* 6 Retrieved 5 August 2010 from <http://www.qualitative-research.net/>.
- Kempen, G. I., Todd, C. J., Van Haastregt, J. C., Zijlstra, G. A., Beyer, N., Freiburger, E., et al. (2007). Cross-cultural validation of the Falls Efficacy Scale International (FES-I) in older people: Results from Germany, the Netherlands and the UK were satisfactory. *Disability and Rehabilitation*, 29(2), 155-162.
- Kempen, G. I., Yardley, L., Van Haastregt, J. C., Zijlstra, G. A., Beyer, N., Hauer, K., et al. (2008). The short FES-I: A shortened version of the Falls Efficacy Scale-International to assess fear of falling. *Age and Ageing*, 37(1), 45-50.
- Kempton, A., Van Beurden, E., Sladden, T., Garner, E., & Beard, J. (2000). Older people can stay on their feet: Final results of a community-based falls prevention program. *Health Promotion International*, 15(1), 27-33.
- Kendig, H., Helme, R., & Teshuva, K. (1996). *Health status of older people project: Preliminary findings from a survey of the health and lifestyles of older Australians*. Melbourne, Australia: Victoria Health Foundation.
- Kesaniemi, Y. K., Danforth, E., Jensen, M. D., Kopelman, P. G., Lefebvre, P., & Reeder, B. A. (2001). Dose-response issues concerning physical activity and health: An evidence-based symposium. *Medicine & Science in Sports & Exercise*, 33(Suppl. 6), S351-358.
- Keysor, J. J. (2003). Does late-life physical activity or exercise prevent or minimize disablement? A critical review of the scientific evidence. *American Journal of Preventive Medicine*, 25(3 Suppl. 2), 129-136.
- King, A. C., Blair, S. N., Bild, D. E., Dishman, R. K., Dubbert, P. M., & Marcus, B. H. (1992). Determinants of physical activity and interventions in adults. *Medicine and Science in Sports and Exercise*, 24 (Suppl. 6), S221-236.
- King, A. C., Taylor, C. B., & Haskell, W. L. (1993). Effects of differing intensities and formats of 12 months of exercise training on psychological outcomes in older adults. *Health Psychology*, 12(4), 292-300.
- Kirkby, R. J., Kolt, S., Habel, K., & Adams, J. (1999). Exercise in older women: Motives for participation. *Australian Psychologist*, 34(2), 122-127.

- Kramer, J., & De Jonge, K. E. (1998). What are elderly patients' definitions of success? *Journal of the American Geriatrics Society*, 46, S86-91.
- Krefting. (1991). Rigor in qualitative research: The assessment of trustworthiness. *The American Journal of Occupational Therapy*, 45(3), 214-222.
- Lach, H. W. (2002). Fear of falling: An emerging public health problem. *Journal of the American Society on Aging*, 26(4), 33-37.
- Lamb, S. E., Hauer, K., & Becker, C. Manual for the fall prevention classification system. Retrieved 29 April 2009, from <http://www.profane.eu.org/>.
- Lamb, S. E., Jorstad-Stein, E. C., Hauer, K., Becker, C., & ProFaNE. (2005). Development of a common outcome data set for fall injury prevention trials: The Prevention of Falls Network Europe consensus. *Journal of the American Geriatrics Society*, 53(9), 1618-1622.
- Larson, A. (2002). Health services and the workforce. In D. Wilkinson & I. Blue (Eds.), *The new rural health*. Melbourne, Australia: Oxford University Press.
- Larson, E. B. (1991). Geriatric medicine. *Journal of the American Medical Association*, 265(23), 3125-3126.
- Latham, N. K., Anderson, C. S., Lee, A., Bennett, D. A., Moseley, A., Cameron, I. D., et al. (2003). A randomized, controlled trial of quadriceps resistance exercise and Vitamin D in frail older people: The Frailty Interventions Trial in Elderly Subjects (FITNESS). *Journal of the American Geriatrics Society*, 51(3), 291-299.
- Lawton, M. P., & Brody, E. M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *Gerontologist*, 9(3), 179-186.
- Lawton, M. P., Winter, L., Kleban, M. H., & Ruckdeschel, K. (1999). Affect and quality of life: Objective and subjective. *Journal of Aging and Health*, 11(2), 169-198.
- Laybourne, A. H., Biggs, S., & Martin, F. C. (2008). Falls exercise interventions and reduced fall rate: Always in the patient's interest? *Age and Ageing*, 37(1), 10-13.
- Lees, F. D., Clark, P. G., Nigg, C. R., & Newman, P. (2005). Barriers to exercise behavior among older adults: A focus-group study. *Journal of Aging and Physical Activity*, 205(13), 23-33.
- Leigh, J. A., Long, P. W., & Barraclough, B. H. (2004). The clinical support systems program: Supporting state-wide implementation. *Medical Journal of Australia*, 180 (Suppl. 6), S101-103.
- Lemay, J. F., & Nadeau, S. (2010). Standing balance assessment in ASIA D paraplegic and tetraplegic participants: Concurrent validity of the Berg Balance Scale. *Spinal Cord*, 48(3), 245-250.
- Leveille, S. G., Cohen-Mansfield, J., & Guralnik, J. M. (2003). The impact of chronic musculoskeletal pain on exercise attitudes, self-efficacy, and physical activity. *Journal of Aging and Physical Activity*, 11(2), 275-283.
- Levett-Jones, T., Lathlean, J., McMillan, M., & Higgins, I. (2007). Belongingness: A montage of nursing students' stories of their clinical placement experiences. *Contemporary Nurse*, 24(2), 162-174.
- Li, F., Fisher, K. J., Harmer, P., & McAuley, E. (2003). Fear of falling in the elderly: Its association with falls, functional ability, and quality of life outcomes. *Journals of Gerontology. Series B, Psychological Sciences and Social Science*, 58B(5), P283-290.
- Li, F., Harmer, P., Fisher, K. J., McAuley, E., Chaumeton, N., Eckstrom, E., et al. (2005). Tai Chi and fall reductions in older adults: A randomised controlled

- trial. *Journals of Gerontology. Series A, Biological Sciences & Medical Sciences*, 60A(2), 187-194.
- Li, F., McAuley, E., Fisher, K. J., Harmer, P., Chaumeton, N. R., & Wilson, N. (2002). Self-efficacy as a mediator between fear of falls and functional ability in the elderly. *Journal of Ageing and Health*, 14(4), 452-466.
- LIFE Study Investigators. (2006). Effects of a physical activity intervention on measures of physical performance: Results of the Lifestyle Interventions and Independence for Elders Pilot (LIFE-P) study. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences* 61A(11), 1157-1165.
- Lin, M. R., Hwang, H., Wang, Y., Chang, S., & Wolf, S. L. (2006). Community-based Tai Chi and its effect on injurious falls, balance, gait, and fear of falls in older people. *Physical Therapy*, 86(9), 1189-1201.
- Lin, M. R., Wolf, S. L., Hwang, H., Gong, M. S., & Chen, C. (2007). A randomised controlled trial of fall prevention programs and quality of life in older fallers. *Journal of the American Geriatrics Society*, 55(4), 499-506.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Beverly Hills, CA: Sage Publications.
- Liu-Ambrose, T., Khan, K. M., Eng, J. J., Janssen, P. A., Lord, S. R., & McKay, H. A. (2004). Resistance and agility training reduce fall risk in women aged 75 to 85 with low bone mass: A 6 month randomised controlled trial. *Journal of the American Geriatrics Society*, 52(5), 657-665.
- Liu-Ambrose, T., Khan, K. M., Eng, J. J., Lord, S. R., & McKay, H. A. (2004). Balance confidence improves with resistance or agility training. Increase is not correlated with objective changes in fall risk and physical abilities. *Gerontology*, 50(6), 373-382.
- Llewellyn, G. (1997). Grounded theory. In J. Higgs (Ed.), *Qualitative research: Discourse on methodologies*. Sydney, Australia: Hampden Press.
- Lomas, J. (1993). Diffusion, dissemination and implementation. Who should do what? *Annals of the New York Academy of Science*, 703, 226-235.
- Lord, S. R. (2004). Evidence-based overview of strategies to modify falls risk-a physiological perspective. In *Australian Falls Prevention Inaugural Conference: From Research to Practice* (pp. 2-2). Sydney, Australia: The Prince of Wales Medical Research Institute.
- Lord, S. R., & Castell, S. (1994). Physical activity program for older persons: Effect on balance, strength, neuromuscular control, and reaction time. *Archives of Physical Medicine & Rehabilitation*, 75(6), 648-652.
- Lord, S. R., Castell, S., Corcoran, J., Dayhew, J., Matters, B., Shan, A., et al. (2003). The effect of group exercise on physical functioning and falls in frail older people living in retirement villages: A randomized controlled trial. *Journal of the American Geriatrics Society*, 51(12), 1685-1692.
- Lord, S. R., Clark, R. D., & Webster, I. W. (1991). Physiological factors associated with falls in an elderly population. *Journal of the American Geriatrics Society*, 39(12), 1194-1200.
- Lord, S. R., & Fitzpatrick, R. C. (2001). Choice stepping reaction time: A composite measure of falls risk in older people. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 56(10), M627-632.
- Lord, S. R., Menz, H. B., & Tiedemann, A. (2003). A physiological profile approach to falls risk assessment and prevention. *Physical Therapy*, 83(3), 237-252.

- Lord, S. R., Shambrook, P. N., & Gilbert, C. (1994). Postural stability, falls and fractures in the elderly: Results from the Dubbo Osteoporosis Epidemiology Study. *Medical Journal of Australia*, 160(11), 688-691.
- Lord, S. R., Sherrington, C., Menz, H. B., & Close, J. C. (2007a). Epidemiology of falls and fall-related injuries. In S. R. Lord, C. Sherrington, H. B. Menz & J. C. Close (Eds.), *Falls in older people: Risk factors and strategies for prevention* (2nd ed.). Cambridge, UK: Cambridge University Press.
- Lord, S. R., Sherrington, C., Menz, H. B., & Close, J. C. (2007b). *Falls in Older People: Risk factors and strategies for prevention* (2nd ed.). Cambridge, UK: Cambridge University Press.
- Lord, S. R., Sherrington, C., Menz, H. B., Close, J. C., & Whitney, J. C. (2007a). Exercise interventions to improve physical functioning. In S. R. Lord, C. Sherrington, H. B. Menz & J. C. Close (Eds.), *Falls in older people: Risk factors and strategies for prevention* (2nd ed.). Cambridge, UK: Cambridge University Press.
- Lord, S. R., Sherrington, C., Menz, H. B., Close, J. C., & Whitney, J. C. (2007b). Exercise interventions to prevent falls. In S. R. Lord, C. Sherrington, H. B. Menz & J. C. Close (Eds.), *Falls in older people: Risk factors and strategies for prevention* (2nd ed.). Cambridge, UK: Cambridge University Press.
- Lord, S. R., Tiedemann, A., Chapman, K., Munro, B., Murray, S. M., & Sherrington, C. (2005). The effect of an individualized fall prevention program on fall risk and falls in older people: A randomised, controlled trial. *Journal of the American Geriatrics Society*, 53(8), 1296-1304.
- Lord, S. R., Ward, J. A., & Williams, P. (1996). Exercise effect on dynamic stability in older women: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, 77(3), 232-236.
- Lord, S. R., Ward, J. A., Williams, P., & Anstey, K. J. (1993). An epidemiological study of falls in older community-dwelling women: The Randwick falls and fractures study. *Australian Journal of Public Health*, 17(3), 240-245.
- Lord, S. R., Ward, J. A., Williams, P., & Anstey, K. J. (1994). Physiological factors associated with falls in older community-dwelling women. *Journal of the American Geriatrics Society*, 42(10), 1110-1117.
- Lord, S. R., Ward, J. A., Williams, P., & Strudwick, M. (1995). The effect of a 12-month exercise trial on balance, strength, and falls in older women: A randomized controlled trial. *Journal of the American Geriatrics Society*, 43(11), 1198-1206.
- Lorig, K. (1986). *A short guide to self-efficacy*. Paper presented at the Arthritis Health Professional Association 21st Annual Scientific Meeting.
- Lovarini, M., Clemson, L., Dean, C., & Mathews, M. (2008). Translating research into practice: Sustainability of a community-based falls prevention program. In *3rd Australian and New Zealand Falls Prevention Conference* (pp. 38-38). Melbourne, Australia: The Australian and New Zealand Falls Prevention Society.
- Lusardi, M. M., & Smith Jr, E. V. (1997). Development of a scale to assess concern about falling and applications to treatment programs. *Journal of Outcome Measurement*, 7(1), 34-55.
- Maher, C. G., Sherrington, C., Herbert, R. D., Moseley, A. M., & Elkins, M. (2003). Reliability of the PEDro Scale for rating quality of randomized controlled trials. *Physical Therapy*, 83(8), 713-721.

- Maibach, E., & Murphy, D. A. (1995). Self-efficacy in health promotion research and practice: Conceptualization and measurement. *Health Education Research*, 10(1), 37-50.
- Makai, B. E., Holliday, P. J., & Topper, A. K. (1991). Fear of falling and postural performance in the elderly. *Journal of Gerontological Medicine and Science*, 46(4), M123-131.
- Mann, M. J., Pruitt, R. H., Meehan, N. K., & Kemper, K. H. (1997). Counselling seniors about physical activity. *Advances for Nurse Practitioners*, 5(7), 37-40.
- Marcus, B. H., Forsyth, L. H., Stone, E. J., Dubbert, P. M., McKenzie, T. L., Dunn, A. L., et al. (2000). Physical activity behavior change: Issues in adoption and maintenance. *Health Psychology*, 19(Suppl.1), 32-41.
- Marks, R., & Allengrante, J. P. (2005). Chronic osteoarthritis and adherence to exercise: A review of the literature. *Journal of Aging and Physical Activity*, 13(4), 434-460.
- Mathers, N., & Huang, Y. C. (2004). Evaluating qualitative research. In P. A. Crookes & S. Davies (Eds.), *Research into practice: Essential skills for reading and applying research in nursing and health sciences* (2nd ed.). Edinburgh, UK: Bailliere Tindall.
- Matjacic, Z., Bohinc, K., & Cikajlo, I. (2009). Development of an objective balance assessment method for purposes of telemonitoring and telerehabilitation in the elderly population. *Disability and Rehabilitation*, 32(3), 259-266.
- Mays, N., & Pope, C. (2000). Qualitative research in health care: Assessing quality in qualitative research. Part 1. *British Medical Journal*, 320(7226), 50-52.
- Mazzeo, R. S., Cavanagh, P., Evans, W. J., Fiatarone, M., Hagberg, J., McAuley, E., et al. (1998). ACSM position stand: Exercise and physical activity for older adults. *Medicine and Science in Sports and Exercise*, 30(6), 992-1008.
- McAuley, E., & Blissmer, B. (2000). Self-efficacy determinants and consequences in physical activity. *Exercise and Sport Science Reviews*, 28(2), 85-88.
- McAuley, E., Jerome, G. J., Marquez, D. X., Elavsky, S., & Blissmer, B. (2003). Exercise self-efficacy in older adults: Social, affective and behavioral influences. *Annals of Behavioral Medicine*, 25(1), 1-7.
- McAuley, E., & Katula, J. (1998). Physical activity interventions in the elderly: Influence on physical health and psychological function. In R. Shulz, G. Maddox & M. P. Lawton (Eds.), *Annual review of Gerontology and Geriatrics*. New York, NY: Springer.
- McAuley, E., Konopack, J. F., Motl, R. W., Morris, K. S., Doerksen, S. E., & Rosengren, K. R. (2006). Physical activity and quality of life in older adults: Influence of health status and self-efficacy. *Annals of Behavioral Medicine*, 31(1), 99-103.
- McAuley, E., Lox, C., & Duncan, T. E. (1993). Long-term maintenance of exercise, self-efficacy and physiological change in older adults. *Journal of Gerontological* 48(4), 218-224.
- McAuley, E., Mihalko, S. L., & Rosengren, K. (1997). Self-efficacy and balance correlates of fear of falling in the elderly. *Journal of Ageing and Physical Activity*, 5(4), 329-340.
- McClure, R. J., Turner, C., Peel, N., Spinks, A., Eakin, E., & Hughes, K. (2005). *Population-based interventions for the prevention of fall-related injuries in older people*: The Cochrane Database of Systematic Reviews. Issue 1. Art No.: CD004441.pub2. DOI:10.1002/14651858. From <http://cochrane.org/reviews/>.

- McDermott, M. M., Liu, K., Ferrucci, L., Criqui, M. H., Greenlan, P., Guralnick, J. M., et al. (2006). Physical performance in peripheral arterial disease: A slower rate of decline in patients who walk more. *Annals of Internal Medicine*, 144(1), 10-20.
- McInnes, E., & Askie, L. (2004). Evidence review on older people's views and experiences of falls prevention strategies. *Worldviews on Evidence Based Nursing*, 1(1), 20-36.
- McLeroy, K. R., Bibeau, D., Steckle, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly*, 15(4), 351-377.
- McMurdo, M. E. (2000). A healthy old age: Realistic or futile goal? *British Medical Journal*, 321(7269), 1149-1151.
- McMurray, A. (1994). Researching rural health: The qualitative approach. *The Australian Journal of Rural Health*, 2(4), 17-24.
- McMurray, A. (2003). *Community health and wellness a sociological approach* (2nd ed.). Sydney, Australia: Mosby.
- McNeill, L. H., Wyrwich, K. W., Brownson, R. C., Clark, E. M., & Kreuter, M. W. (2006). Individual, social environmental, and physical environmental influences on physical activity among black and white adults: A structural equation analysis. *Annals of Behavioral Medicine*, 31(1), 36-44.
- Means, K. M., Rodell, D. E., & O'Sullivan, P. S. (2005). Balance, mobility, and falls among community-dwelling elderly persons: Effects of a rehabilitation exercise program. *American Journal of Physical Medicine and Rehabilitation*, 84(4), 238-250.
- Mendes de Leon, C. F., Seeman, T. E., Baker, D. I., Richardson, E. D., & Tinetti, M. E. (1995). Self-efficacy, physical decline and change in functioning of community living elderly. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 51B(4), 183-190.
- Miller, M. E., Rejeski, W. J., Reboussein, B. A., Ten Have, T. R., & Ettinger, W. H. (2000). Physical activity, functional limitations, and disability in older adults. *Journal of the American Geriatrics Society*, 48(10), 1264-1272.
- Mills, J., Bonner, A., & Francis, K. (2006). The development of constructivist grounded theory [Electronic Version]. *International Journal of Qualitative Methods*, 5, Article 3. Retrieved 6 August 2010 from <http://www.ualberta.ca/>.
- Moller, J. (2003). *Projected costs of fall related injury to older persons due to demographic change in Australia*: Publication 3314. Commonwealth Government: Canberra, Australia.
- Moore, D. S., & Ellis, E. (2008). Measurement of fall-related psychological constructs among independent-living older adults: A review of the research literature. *Aging and Mental Health*, 12(6), 684-699.
- Moore, K., Hempton, C., Galvin, P., Hill, K., Renham, E., & Hill, A. (2008). Review of projects to prevent falls among older people in Victoria 2000-2007. In *3rd Australian and New Zealand Falls Prevention Conference* (pp. 17-17). Melbourne, Australia: The Australian and New Zealand Falls Prevention Society.
- Moran-Ellis, J., Alexander, V. D., Cronin, A., Dickinson, M., & Fielding, J. (2006). Triangulation and integration: Processes, claims and implications. *Qualitative Research*, 6(45), 45-59.
- Moreland, J., Richardson, J., Chan, D. H., O'Neill, J., Bellissimo, A., Grum, R. M., et al. (2003). Evidence-based guidelines for the secondary prevention of falls in older adults. *Gerontology*, 49(2), 93-116.

- Morey, M. C., Pieper, C. F., & Cornoni-Huntley, J. (1998). Physical fitness and functional limitations in community-dwelling older adults. *Medicine and Science in Sports and Exercise*, 30(5), 715-723.
- Morgan, D. L. (1998). Practical strategies for combining qualitative and quantitative methods: Applications to health research. *Qualitative Health Research*, 8(3), 362-376.
- Morris, L. V., & Palmer, H. T. (1994). Rural and urban differences in employment and vacancies in ten allied health professions. *Journal of Allied Health*, 23(3), 143-153.
- Morse, J. M. (1994). Designing funded qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research*. Thousand Oaks, CA: Sage Publications.
- Morse, J. M. (2003). Principals of mixed methods and multimethod research design. In A. Tashakkori & C. B. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural sciences*. Thousand Oaks, CA: Sage Publications.
- Muir, S. W., Berg, K., Chesworth, B., & Speechley, M. (2008). Use of the Berg Balance Scale for predicting multiple falls in community-dwelling elderly people: A prospective study. *Physical Therapy*, 88(4), 449-459.
- Murphy, S. L., Williams, C. S., & Gill, T. M. (2002). Characteristics associated with fear of falling and activity restriction in community-living older persons. *Journal of the American Geriatrics Society*, 50(3), 516-520.
- Muse, T. (2005). Motivation and adherence to exercises for older adults. *Topics in Geriatric Rehabilitation*, 21(2), 107-115.
- Myers, A. M., Fletcher, P. C., Myers, A. H., & Sherk, W. (1998). Discriminative and evaluative properties of the Activities-Specific Confidence (ABC) Scale. *Journals of Gerontology. Series A, Biological Sciences & Medical Sciences*, 53A(4), M287-294.
- Myers, A. M., Powell, L. E., Mali, B. E., Holliday, P. J., Brawley, L. R., & Sherk, W. (1996). Psychological indicators of balance confidence: Relationship to actual and perceived abilities. *Journals of Gerontology. Series A, Biological Sciences & Medical Sciences*, 51A(1), M37-43.
- National Ageing Research Institute. (2004). *National falls prevention for older people initiative. An analysis of research on preventing falls and falls injury in older people: Community, residential care and hospital settings (2004 update)*: Australian Government Department of Health and Ageing: Melbourne, Australia. From <http://www.health.gov.au/>.
- National Institute for Health and Clinical Excellence (NICE). (2004a). *Clinical practice guideline for the assessment and prevention of falls in older people*: National Collaborating Centre for Nursing and Supporting Care: London, UK. From <http://www.nice.org.uk>.
- National Institute for Health and Clinical Excellence (NICE). (2004b). *Falls: The assessment and prevention of falls in older people*: Clinical guideline 21. NICE: London, UK. From <http://www.nice.org.au>.
- National Public Health Partnership. (2005a). *The national injury prevention and safety promotion plan: 2004-2014*: National Public Health Partnership: Canberra, Australia. From <http://www.dhs.vic.gov.au>.
- National Public Health Partnership. (2005b). *National falls prevention for older people plan: 2004 onwards*: National Public Health Partnership: Canberra, Australia. From <http://www.dhs.vic.gov.au>.

- National Public Health Partnership (NPHP). (2004). *The national falls prevention for older people plan: 2004 onwards*: National Public Health Partnership: Canberra, Australia. From <http://www.dhs.vic.gov.au>.
- National Roads and Motorists Association. (n.d.). Trip Planner. Retrieved 26 June 2010, from <http://www.drivethere.com.au/>.
- National Rural Health Alliance. (2002). *Healthy horizons. A framework for improving the health of rural and remote Australians. Summary of progress across Australia*: National Rural Health Policy Sub-committee: Canberra, Australia. From <http://nrha.ruralhealth.org.au/>.
- National Rural Health Alliance. (2004). *Older people and aged care in rural, regional and remote Australia*: National Rural Health Alliance: Canberra, Australia. From <http://nrha.ruralhealth.org.au/>.
- National Rural Health Alliance. (2005). *Health and rural infrastructure. Inquiry into infrastructure and the development of Australia's regional areas. Submission to House of Representatives Standing Committee on Primary Industries and Regional Services*: National Rural Health Alliance: Canberra, Australia. From <http://nrha.ruralhealth.org.au/>.
- National Rural Health Alliance/Aged and Community Services Australia. (2005). *Position paper-Older people and aged care in rural, regional and remote Australia: National policy position*: National Rural Health Alliance and Aged and Community Services Australia: Canberra, Australia. From http://www.agedcare.org.au/POLICIES-&-POSITION/Policies/Rural_remote_policy05.pdf.
- National Rural Health Policy Forum and National Rural Health Alliance. (1999). *Healthy Horizons 1999-2003: A framework for improving the health of rural regional and remote Australians*: National Rural Health Alliance: Canberra, Australia. From <http://nrha.ruralhealth.org.au/>.
- Nelson, M. E., Layne, J. E., Bernstein, M. J., Nuernberger, A., Castaneda, C., Kaliton, D., et al. (2004). The effects of multidimensional home-based exercise on functional performance in elderly people. *Journals of Gerontology. Series A, Biological Sciences & Medical Sciences*, 59A(2), 154-160.
- Netz, Y., Wu, M. J., Becker, B. J., & Tenenbaum, G. (2005). Physical activity and psychological well-being in advanced age: A meta analysis of intervention studies. *Psychology and Ageing*, 20(2), 272-284.
- Neuroscience Research Australia. (n.d.). Falls and Balance Research Group,. Retrieved 23 July 2010, from <http://www.neura.edu.au/>.
- Nitz, J. C., & Choy, N. L. (2004). The efficacy of a specific balance-strategy training programme for preventing falls among older people: A pilot randomised controlled trial. *Age & Ageing*, 33(1), 52-58.
- Nivitt, M. C., Cummings, S. R., Kidd, S., & Black, D. (1989). Risk factors for recurrent nonsyncopal falls: A prospective study. *Journal of the American Geriatrics Society*, 26(18), 2663-2668.
- Nolan, J. S. (2008). Consumer views of exercise advice: Views of older people following fall-related hospital admissions. In *3rd Australian and New Zealand Falls Prevention Conference* (pp. 43-43). Melbourne, Victoria: The Australian and New Zealand Falls Prevention Society.
- NSW Health Department. (1999). *Indicators to help with capacity building in health promotion*: NSW Health Department: Sydney, Australia. From <http://www.health.nsw.gov.au/>.

- NSW Health Department. (2001). *A framework for building capacity to improve health*: NSW Health Department: Sydney, Australia. From <http://www.health.nsw.gov.au/>.
- NSW Health Department. (2005). *Rural falls injury prevention program: Report of interventions and outcomes*: NSW Health Department: Sydney, Australia. From <http://www.health.nsw.gov.au>.
- Nugent, J. A., Schurr, K. A., & Adams, R. D. (1994). A dose-response relationship between amount of weight-bearing exercise and walking outcome following cerebrovascular accident. *Archives of Physical Medicine and Rehabilitation*, 75(4), 399-402.
- Nutbeam, D., & Harris, E. (1998). *Theory in a nutshell. A practitioner's guide to commonly used theories and models in health promotion*: National Centre for Health Promotion: Sydney, Australia.
- O'Cathain, A., & Thomas, K. (2006). Combining qualitative and quantitative methods. In C. Pope & N. Mays (Eds.), *Qualitative research in health care* (3rd ed.). Malden, MA: Blackwell Publishing.
- O'Leary, A. (1985). Self-efficacy and health. *Behaviour Research and Therapy*, 23(4), 437-461.
- Oxman, A. D., Thomson, M. A., Davis, D. A., & Haynes, R. B. (1995). No magic bullets: A systematic review of 102 trials of interventions to improve professional practice. *Canadian Medical Association Journal*, 153(10), 1423-1431.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Pauwels, R. A., Buist, A. S., Calverley, P. M., Jenkins, C. R., & Hurd, S. S. (2001). GOLD Scientific Committee. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. NHLBI/WHO Global Initiative for Chronic Obstructive Lung Disease (GOLD) workshop summary. *American Journal of Respiratory and Critical Care Medicine*, 163(5), 2309-2316.
- Paxton, S. J., Browning, C. J., & O'Connell, G. (1997). Predictors of exercise program participation in older women. *Psychology and Health*, 12(4), 543-552.
- Peterson, E., Howland, J., Kielhofner, G., Lachman, M. E., Assumann, S., Cote, J., et al. (1999). Falls self-efficacy and occupational adaptation among elders. *Physical and Occupational Therapy in Geriatrics*, 16(1/2), 1-16.
- Petruzzello, S. J., Landers, D. M., Hatfield, B. D., Kubitz, K. A., & Salazar, W. (1991). A meta-analysis on the anxiety-reducing effects of acute and chronic exercise: Outcomes and mechanisms. *Sports Medicine*, 11(3), 143-182.
- Pfeiffer, E. (1975). A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *Journal of the American Geriatrics Society*, 23(10), 433-441.
- Phelan, E. A., Anderson, L. A., LaCroix, A. Z., & Larson, E. B. (2004). Older adults views of 'successful aging' - How do they compare with researchers' definitions? *Journal of the American Geriatrics Society*, 52(2), 211-216.
- Piotrowski, A., & Cole, J. (1994). Clinical measures of balance confidence and functional assessment in elderly persons. *Australian Journal of Physiotherapy*, 40(3), 183-188.
- Podsiadlo, D., & Richardson, S. (1991). The timed "Up & Go": A test of basic functional mobility for frail elderly persons. *Journal of the American Geriatrics Society*, 39(2), 142-148.

- Polit, D. F., & Beck, C. T. (2004). *Nursing research: Principals and methods* (7th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.
- Pollock, M. L., Franklin, B. A., Balady, G. J., Chaitman, B. L., Fleg, J. L., Fletcher, B., et al. (2000). AHA Science Advisory. Resistance exercise in individuals with and without cardiovascular disease: Benefits, rationale, safety, and prescription: An advisory from the Committee on Exercise, Rehabilitation, and Prevention, Council on Clinical Cardiology, American Heart Association; Position paper endorsed by the American College of Sports Medicine. *Circulation*, 101(7), 828-833.
- Pollock, M. L., Gaesser, G. A., Butcher, J. D., Despres, J. P., Dishman, R. K., Franklin, B. A., et al. (1998). ACSM position stand: The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults. *Medicine and Science in Sports and Exercise*, 30(6), 975-991.
- Pope, C., & Mays, N. (2006). Qualitative methods in health research. In C. Pope & N. Mays (Eds.), *Qualitative research in healthcare* (3rd ed.). Malden, MA: Blackwell Publishing.
- Pope, C., Ziebland, S., & Mays, N. (2000). Qualitative research in health care: Analysing qualitative data. Part 2. *British Medical Journal*, 320(7227), 114-116.
- Pope, C., Ziebland, S., & Mays, N. (2006). Analysing qualitative data. In C. Pope & N. Mays (Eds.), *Qualitative research in health care* (3rd ed.). Malden, MA: Blackwell Publishing.
- Portney, L. G., & Watkins, M. P. (2009). *Foundations of clinical research* (3rd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Powell, L. E., & Myers, A. M. (1995). The Activities-Specific Balance Confidence (ABC) Scale. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 50A(1), M28-34.
- Province, M. A., Hadley, E. C., Hornbrook, M. C., Lipsitz, L. A., Miller, J. P., Mulrow, C. D., et al. (1995). The effects of exercise on falls in elderly patients. A preplanned meta-analysis of the FICSIT Trials. Frailty injuries: Cooperative Studies of Intervention Techniques. *Journal of the American Medical Association*, 273(17), 1341-1347.
- Prudham, D., & Evans, J. G. (1981). Factors associated with falls in the elderly: A community study. *Age and Ageing*, 10(3), 141-146.
- Qutubuddin, A. A., Pegg, P. O., Cifu, D. X., Brown, K., McNamee, S., & Carne, W. (2005). Validating the Berg Balance Scale for patients with Parkinson's disease: A key to rehabilitation evaluation. *Archives of Physical Medicine and Rehabilitation*, 86(11), 2225-2226.
- Rallis, S. F., & Rossman, G. B. (2003). Mixed methods in evaluation contexts: A pragmatic framework. In A. Tashakkori & C. B. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural sciences*. Thousand Oaks, CA: Sage Publications.
- Ranzijn, R., Harford, J., & Andrews, G. (2002). Aging and economy: Costs and benefits. *Australasian Journal on Aging*, 21(3), 145-151.
- Rasiah, M., Hirvensalo, M., Leinonen, R., Lintunen, T., & Rantanen, T. (2006). Motives for and barriers to physical activity among older adults with mobility limitations. *Journal of Aging and Physical Activity*, 15(1), 90-102.
- Reason, J. (2000). Human error: Models and management. *British Medical Journal*, 320(7237), 768-770.

- Rejeski, W. J., & Mihalko, S. L. (2001). Physical activity and quality of life in older adults. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 56A(Special issue II), 23-35.
- Resnick, B., & Spellbring, A. M. (2000). Understanding what motivates older adults to exercise. *Journal of Gerontological Nursing*, 26(3), 34-42.
- Rice, P. L., & Ezzy, D. (1999). *Qualitative research methods: A health focus*. Melbourne, Australia: Oxford University Press.
- Richards, L. (2005). *Handling qualitative data: A practical guide*. Thousand Oaks, CA: Sage Publications.
- Richards, L., & Morse, J. M. (2007). *Readme first for a users guide to qualitative research* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Rixt Zijlstra, G. A., van Haastregt, J. C., van Rossum, E., van Eijk, J., Yardley, L., & Kempton, G. I. (2007). Interventions to reduce fear of falling in community-living older people: A systematic review. *Journal of the American Geriatrics Society*, 55(4), 603-615.
- Rizzo, J. A., Baker, D. I., McAvay, G., & Tinetti, M. E. (1996). The cost-effectiveness of a multi-factorial targeted prevention program for falls among community elderly persons. *Medical Care*, 34(9), 954-969.
- Robbins, A. S., Rubenstein, L. Z., Josephson, K. R., Schulman, B. L., Osterweil, D., & Fine, G. (1989). Predictors of falls among elderly people. Results of two population-based studies. *Archives of Internal Medicine*, 149(7), 1628-1633.
- Robertson, M. C., Devlin, N., Gardner, M. M., & Campbell, A. J. (2001). Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls. 1: Randomised controlled trial. *British Medical Journal*, 322(7288), 697-701.
- Robertson, M. C., Devlin, N., Scuffham, P., Gardner, M. M., Buchner, D. M., & Campbell, A. J. (2001). Economic evaluation of a community based exercise programme to prevent falls. *Journal of Epidemiology & Community Health*, 55(8), 600-606.
- Robinson, A. (2008). A framework for translating falls evidence into action. In *3rd Australian and New Zealand Falls Prevention Conference*. (pp. 38-38). Melbourne, Australia: The Australian and New Zealand Falls Prevention Society.
- Rogers, E. (1983). *Diffusion of innovations*. New York, NY: Free Press.
- Rowe, J. W., & Kahn, R. L. (1998). *Successful Ageing*. New York, NY: Random House.
- Rubenstein, L. Z., & Josephson, K. R. (2002). The epidemiology of falls and syncope. *Clinical Geriatric Medicine*, 18(2), 141-158.
- Rubenstein, L. Z., Powers, C. M., & MacLean, C. H. (2001). Quality indicators for the management and prevention of falls and mobility problems in vulnerable elders. *Annals of Internal Medicine*, 135(8 Pt. 2), 686-693.
- Russell, D. W., Cutrona, C. E., de la Mora, A., & Wallace, R. B. (1997). Loneliness and nursing home admission among rural older adults. *Psychology and Aging*, 12(4), 574-589.
- Sage Research Methods Online. (2011). Journal of Mixed Methods Research. Retrieved 18 May 2008 from <http://intl-mmr.sagepub.com/>.
- Salbach, N. M., Mayo, N. E., Higgins, J., Ahmed, S., Finch, L. E., & Richards, C. L. (2001). Responsiveness and predictability of gait speed and other disability measures in acute stroke. *Archives of Physical Medicine & Rehabilitation*, 82(9), 1204-1212.

- Sale, D. G. (1988). Neural adaptation to resistance training. *Medicine and Science in Sports and Exercise*, 20 (Suppl. 5), S135-145.
- Salkeld, G., Cameron, I. D., Cumming, R. G., Easter, S., Seymour, J., & Kurrle, S. E. (2000). Quality of life related to fear of falling and hip fracture in older women. *British Medical Journal*, 320(7231), 341-346.
- Sanders, K. M., Nicholson, G. C., Ugoni, A. M., Pasco, J. A., Seeman, E., & Kotowicz, M. A. (1999). Health burden of hip and other fractures in Australia beyond 2000: Projections based on the Geelong Osteoporosis Study. *Medical Journal of Australia*, 170(10), 467-470.
- Sanson-Fisher, R. W. (2004). Diffusion of innovation theory for clinical change. *Medical Journal of Australia*, 180 (Suppl. 6), S55-56.
- Schoo, A. M., Stagnitti, K. E., Mercer, C., & Dunbar, J. (2005). A conceptual model for recruitment and retention: Allied health workforce enhancement in western Victoria, Australia [Electronic Version]. *Rural and Remote Health*, 5. Retrieved 2 November 2009 from <http://www.rrh.org.au>.
- Seeman, T., & Chen, X. (2002). Risk and protective factors for physical functioning in older adults with and without chronic conditions: MacArthur Studies of Successful Aging. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 57B(3), S135-143.
- Seeman, T. E., Unger, J. B., McAvay, G., & Mendes de Leon, C. F. (1999). Self-efficacy beliefs and perceived declines in functional ability: Macarthur studies of successful aging. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 54B(4), 214-222.
- Sheppard, L. (2001). Work practices of rural and remote physiotherapists. *Australian Journal of Rural Health*, 9(2), 85-91.
- Sheppard, L. (2005). What the people want-Delivery of health services in rural and remote Australia [Electronic Version]. *The Internet Journal of Allied Health Sciences and Practice*, 3. Retrieved 14 January 2011 from <http://ijahsp.nova.edu/>.
- Sherrington, C., & Lord, S. R. (2005). Reliability of simple portable tests of physical performance in older people after hip fracture. *Clinical Rehabilitation*, 19(5), 496-504.
- Sherrington, C., Lord, S. R., & Finch, C. F. (2004). Physical activity interventions to prevent falls among older people: Update on the evidence. *Journal of Science and Medicine in Sport*, 7(Suppl. 1), 43-51.
- Sherrington, C., Lord, S. R., & Herbert, R. D. (2003). A randomised trial of weight-bearing versus non-weight-bearing exercise for improving physical ability in inpatients after hip fracture. *Australian Journal of Physiotherapy*, 49(1), 15-22.
- Sherrington, C., Pamphlett, P. I., Jacka, J. A., Olivetti, L. M., Nugent, J. A., Dorsch, S., et al. (2008). Group exercise can improve participants' mobility in an outpatient rehabilitation setting: A randomized controlled trial. *Clinical Rehabilitation*, 22(6), 493-502.
- Sherrington, C., Whitney, J. C., Lord, S. R., Herbert, R. D., Cummings, S. R., & Close, J. C. (2008). Effective exercise for the prevention of falls: A systematic review and meta analysis. *Journal of the American Geriatrics Society*, 56(12), 2234-2243.
- Shumway-Cook, A., Baldwin, M., Polissar, N. L., & Gruber, W. (1997). Predicting the probability of falls in community-dwelling older adults. *Physical Therapy*, 77(8), 812-819.

- Simpson, J. M., Darwin, C., & Marsh, N. (2003). What are older people prepared to do to avoid falling? A qualitative study in London. *British Journal of Community Nursing*, 8(4), 152-159.
- Sjosten, N. M., Salonoja, M., Piirtola, M., Vahlberg, T. J., Isoaho, R., Hyttinen, H. K., et al. (2007). A multifactorial fall prevention programme in the community-dwelling aged: Predictors of adherence. *European Journal of Public Health*, 17(5), 464-470.
- Skelton, D. A., Dinan, S. M., Campbell, M., & Rutherford, O. (2005). Tailored group exercise (Falls Management Exercise-FaME) reduces falls in community-dwelling older frequent fallers (an RCT). *Age & Ageing*, 34(6), 636-639.
- Smith, R. (1994). Validation and reliability of the Elderly Mobility Scale. *Physiotherapy*, 80(11), 744-747.
- Somers, M. (1999). *Development and preliminary validation of a measure of belongingness*. (Unpublished doctoral dissertation). Temple University: Philadelphia, USA.
- Sousa, N., & Sampaio, J. (2005). Effects of progressive strength training on the performance of the functional reach test and the timed-up-and-go test in an elderly population from rural northern Portugal. *American Journal of Human Biology*, 17(6), 746-751.
- Southon, G. (1996). Health service structures, management and professional practice, beyond clinical judgement. *Australian Health Review*, 19(1), 2-16.
- Stathi, A., Fox, K. R., & McKenna, J. (2002). Physical activity and dimensions of subjective well-being in older adults. *Journal of Aging and Physical Activity*, 10(1), 76-92.
- Stead, M., Wimbrush, E., Eadie, D., & Teer, P. (1997). A qualitative study of older people's perceptions of ageing and exercise: The implications for health promotion. *Health Education Journal* 56(1), 3-16.
- Stevens, M., Holman, C. D., Bennett, N., & de Klerk, N. (2001). Preventing falls in older people: Outcome evaluation of a randomized controlled trial. *Journal of the American Geriatrics Society*, 49(11), 1448-1455.
- Stewart, A. L., & King, A. C. (1991). Evaluating the efficacy of physical activity for influencing quality-of-life outcomes in older adults. *Annals of Behavioral Medicine*, 13(3), 108-116.
- Straus, S. E., Tetroe, S. E., & Graham, I. D. (2010). Defining knowledge translation. *Canadian Medical Association Journal*, 181(3-4), 165-186.
- Strauss, A. (1987). *Qualitative analysis for social scientists*. New York, NY: Cambridge University Press.
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Thousand Oaks, CA: Sage Publications.
- Strauss, A. C., & Corbin, J. (1994). Grounded theory methodology: An overview. In N. Denzin & L. Y. (Eds.), *Handbook of qualitative research*. Thousand Oaks, CA: Sage Publications.
- Strauss, A. C., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Strawbridge, W. J., Deleger, S., Roberts, R. E., & Kaplan, G. A. (2002). Physical activity reduces the risk of subsequent depression for older adults. *American Journal of Epidemiology*, 156(4), 328-334.

- Strecher, V. J., McEvoy, D. E., Vellis, B. M., Becker, M. H., & Rosenstock, I. M. (1986). The role of self-efficacy in achieving health behaviour. *Health Education Quarterly*, 13(1), 73-91.
- Stretton, C. M. (2006). Determinants of physical health in frail older people: The importance of self-efficacy. *Clinical Rehabilitation*, 20(4), 357-366.
- Streubert Speziale, H. J., & Carpenter, D. R. (2007). *Qualitative research in nursing: Advancing the humanistic imperative* (4th ed.). Philadelphia, PA: Lippincott Williams and Wilkins.
- Swindlehurst, H. F., Deaville, J. A., Wynne-Jones, J., & Mitchinson, K. (2005). Rural proofing for health: A commentary [Electronic Version]. *Rural and Remote Health*, 5, 411. Retrieved 8 November 2008 from <http://www.rrh.org.au>.
- Taggart, H. M. (2002). Effects of Tai Chi exercise on balance, functional mobility, and fear of falling among older women. *Applied Nursing Research*, 15(4), 235-242.
- Talley, K. M., Wyman, J. F., & C.R., G. (2008). Psychometric properties of the Activities-Specific Balance Confidence Scale and the survey of activities and fear of falling in older women. *Journal of the American Geriatrics Society*, 56(2), 328-333.
- Tashakkori, A., & Teddlie, C. B. (2003a). Major issues and controversies in the use of mixed methods in the social and behavioural sciences. In A. Tashakkori & C. B. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural research*. Thousand Oaks, CA: Sage Publications.
- Tashakkori, A., & Teddlie, C. B. (2003b). The past and future of mixed methods research: From data triangulation to mixed model designs. In A. Tashakkori & C. B. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural research*. Thousand Oaks, CA: Sage Publications.
- Tennstedt, S., Howland, J., & Lackman, M. (1998). A randomized controlled trial of a group intervention to reduce fear of falling and activity restriction in older adults. *Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 53(6), 384-392.
- Tiedemann, A., Shimada, H., Sherrington, C., Murray, S., & Lord, S. (2008). The comparative ability of eight functional mobility tests for predicting falls in community-dwelling older people [Electronic Version]. *Age and Ageing*, 37, 430-435. Retrieved 8 July 2009.
- Tinetti, M. E. (1986). Performance-oriented assessment of mobility problems in elderly patients. *Journal of the American Geriatrics Society*, 34(2), 119-126.
- Tinetti, M. E. (2001). Where is the vision for fall prevention? *Journal of the American Geriatrics Society*, 49(5), 676-677.
- Tinetti, M. E. (2004). Prevention of falls and fall injuries in older people: A research agenda. *Preventative Medicine*, 23(5), 756-762.
- Tinetti, M. E. (2008). Multifactorial fall prevention strategies: Time to retreat or advance. *Journal of the American Geriatrics Society*, 58(8), 1563-1565.
- Tinetti, M. E., Mendes de Leon, C. F., Doucette, J. T., & Baker, D. I. (1994). Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. *Journal of Gerontology*, 49(3), M140-147.
- Tinetti, M. E., & Powell, L. (1993). Fear of falling and low self-efficacy: A cause of dependence in elderly persons. *Journal of Gerontology*, 48(Special Issue), 35-38.
- Tinetti, M. E., Richman, D., & Powell, L. (1990). Falls efficacy as a measure of fear of falling. *Journal of Gerontology*, 45(6), 239-243.

- Tinetti, M. E., Speechley, M., & Ginter, S. F. (1988). Risk factors for falls among elderly persons living in the community. *New England Journal of Medicine*, 319(26), 1701-1707.
- Tinetti, M. E., & Williams, C. S. (1997). Falls, injuries due to falls, and the risk of admission to a nursing home. *New England Journal of Medicine*, 337(18), 1279-1284.
- Tinetti, M. E., & Williams, C. S. (1998). The effect of falls and fall injuries on functioning in community-dwelling older persons. *Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 53A(2), M112-119.
- Tinetti, M. E., Williams, T. F., & Mayewski, R. (1986). Fall risk index for elderly patients based on number of chronic conditions. *American Journal of Medicine*, 80(3), 429-434.
- Todd, C., & Skelton, D. A. (2004). *What are the main risk factors for falls amongst older people and what are the most effective interventions to prevent these falls*: Health Evidence Network Report 180908. WHO Regional Office for Europe: Copenhagen, Denmark. From <http://www.euro.who.int/document/E82552.pdf>.
- Tunis, S. R., Stryer, D. B., & Clancey, C. M. (2003). Practical clinical trials: Increasing the value of clinical research for decision making in clinical and health policy. *Journal of the American Medical Association*, 290(12), 1624-1632.
- Tyson, S. F., & Connell, L. A. (2009). How to measure balance in clinical practice: A systematic review of the psychometrics and clinical utility of measures of balance activity for neurological conditions. *Clinical Rehabilitation*, 23(9), 824-840.
- Vaapio, S. S., Salminen, M. J., Ojanlatva, A., & Kivela, S. L. (2008). Quality of life as an outcome measure of fall prevention interventions among the aged: A systematic review. *European Journal of Public Health*, 19(1), 7-15.
- Vaapio, S. S., Salminen, M. J., Vahlberg, T. J., Sjosten, N. M., Isoaho, R., Aarnio, P. T., et al. (2007). Effects of risk-based multifactorial fall prevention on health-related quality of life among the community-dwelling aged: A randomized controlled trial [Electronic Version]. *Health and Quality of Life Outcomes*, 5, 1-8. Retrieved 2 August 2009 from <http://www.hqlo.com/>.
- Veitch, C., & Battye, K. (2008). Rural health workforce: Planning and development for recruitment and retention. In S. Liaw & S. Kilpatrick (Eds.), *A textbook of Australian rural health*. Canberra, Australia: Australian Rural Health Education Network.
- Verbaken, J. H., & Johnston, A. W. (1986). Population norms for edge contrast sensitivity. *American Journal of Optometry and Physiological Optics*, 63(9), 724-732.
- Vogler, C. M., Sherrington, C., Ogle, S. J., & Lord, S. R. (2009). Reducing risk of falling in older people discharged from hospital: A randomized controlled trial comparing seated exercises, weight-bearing exercises and social visits. *Archives of Physical Medicine and Rehabilitation*, 90(8), 1317-1324.
- Volunteering Australia. (2006). *Inaugural volunteering research symposium*: Volunteering Australia: Melbourne, Australia. From <http://www.volunteeringaustralia.org/>.
- von Faber, M., Bootsma-van der Wiel, A., van Exel, E., Gussekloo, J., Lagaay, A. M., van Dongen, E., et al. (2001). Successful aging in the oldest old: Who can be characterised as successfully aged? *Archives of Internal Medicine*, 161(22), 2694-2700.

- Voukelatos, A., Cumming, R. G., Lord, S. R., & Rissel, C. (2007). A randomized, controlled trial of Tai Chi for the prevention of falls: The Central Sydney Tai Chi trial. *Journal of the American Geriatrics Society*, 55(8), 1185-1191.
- Wagner, E. H., LaCroix, A. Z., Grothaus, L., Leveille, S. G., Hecht, J. A., Artz, K., et al. (1994). Prevention of disability and falls in older adults: A population-based randomized trial. *American Journal of Public Health*, 84(11), 1800-1806.
- Wakeman, J., & Humphreys, J. (2008). Rural and remote health-definitions, policy and priorities. In S. Liaw & S. Kilpatrick (Eds.), *A textbook of Australian Rural Health*. Canberra, Australia: Pirion.
- Wakeman, J., Humphreys, J., Wells, R., Kuipers, P., Entwistle, P., & Jones, J. (2006). *A systematic review of primary health care delivery models in rural and remote Australia 1993-2006*: Australian Primary Health Care Research Institute, The Australian National University: Canberra, Australia.
- Wakeman, J., & Humphreys, J. S. (2002). Rural health: Why it matters. *Medical Journal of Australia*, 176(10), 457-458.
- Wakeman, J., & Lenthall, S. (2002). Remote health. In D. Wilkinson & I. Blue (Eds.), *The new rural health*. Melbourne, Australia: Oxford University Press.
- Walker, J. E., & Howland, J. (1991). Falls and fear of falling among elderly people living in the community: Occupational therapy interventions. *American Journal of Occupational Therapy*, 45(2), 119-122.
- Ward-Griffin, C., Hobson, S., Melles, P., Kloseck, M., Vandervoort, A., & Crilly, R. (2004). Falls and fear of falling among community-dwelling seniors: The dynamic tension between exercising precaution and striving for independence. *Canadian Journal on Ageing*, 23(4), 307-318.
- Ware, J., Jr., Kosinski, M., & Keller, S. D. (1996). A 12-Item Short-Form Health Survey: Construction of scales and preliminary tests of reliability and validity. *Medical Care*, 34(3), 220-233.
- Welch, N. (2000). Understanding the determinants of rural health [Electronic Version]. Retrieved 2 February 2011 from http://nrha.ruralhealth.org.au/cms/uploads/publications/03_welch_00.pdf.
- Wenger, G. C. (1992). Morale in old age: A review of the evidence. *International Journal of Geriatric Psychiatry*, 7(10), 699-708.
- Wensing, M., Bosch, M., & Grol, R. (2010). Developing and selecting interventions for translating knowledge to action. *Canadian Medical Association Journal*, 182(2), E85-88.
- Wentowski, G. J. (1981). Reciprocity and coping strategies of older people: Cultural dimensions of network building. *Gerontologist*, 21(6), 600-609.
- Whitney, S., Wrisley, D., & Furman, J. (2003). Concurrent validity of the Berg Balance Scale and the Dynamic Gait Index in people with vestibular dysfunction. *Physiotherapy Research International*, 8(4), 178-186.
- Williams, E., D'Amore, W., & McMeeken, J. (2007). Physiotherapy in rural and regional Australia *Australian Journal of Rural Health*, 15(6), 380-386.
- Williams, P., & Lord, S. R. (1995). Predictors of adherence to a structured exercise program for older women. *Psychology and Ageing*, 10(4), 617-624.
- Wolf, S. L., Barnhart, H. X., Kutner, N. G., McNeely, E., Coogler, C., & Xu, T. (1996). Reducing frailty and falls in older persons: An investigation of Tai Chi and computerized balance training. Atlanta FICSIT Group. Frailty and Injuries: Cooperative Studies of Intervention Techniques. *Journal of the American Geriatrics Society*, 44(5), 489-497.

- Wood-Dauphinee, S. L., Berg, K. O., Bravo, G., & Williams, J. I. (1997). The Balance Scale: Responsiveness to clinically meaningful changes. *Canadian Journal of Rehabilitation*, 10(1), 35-50.
- World Health Organisation. (1998). *Growing older. Staying well. Aging and physical activity in everyday life* WHO/HPR/AHE/98.1. World Health Organisation: Geneva, Switzerland. From http://whqlibdoc.who.int/hq/1998/WHO_HPR_AHE_98.1.pdf.
- World Health Organisation. (2002). *Active ageing: A policy framework*: WHO/NMA/NPH/02.8. World Health Organisation: Madrid, Spain. From <http://whqlibdoc.who.int/>.
- World Health Organisation. (2003). ICF checklist, version 2.1A, clinician form for International Classification of Functioning, Disability and Health: World Health Organisation [Electronic Version], 1-15. Retrieved 10 November 2010 from <http://www.who.int/classifications/icf/training/icfchecklist.pdf>.
- Wrisley, D. M., & Kumar, N. A. (2010). Functional Gait Assessment: Concurrent, discriminative and predictive validity in community-dwelling older adults. *Physical Therapy*, 90(5), 774-775.
- Yardley, L., Beyer, N., Hauer, K., Kempen, G., Piot-Ziegler, C., & Todd, C. (2005). Development and initial validation of the Falls Efficacy Scale-International (FES-I). *Age & Ageing*, 34(6), 614-619.
- Yardley, L., Bishop, F. L., Beyer, N., Hauer, K., Kempen, G. I., Piot-Ziegler, C., et al. (2006). Older people's views of falls prevention interventions in six European countries. *The Gerontologist*, 46(5), 650-660.
- Yardley, L., Donovan-Hall, M., Francis, K., & Todd, C. (2006). Older people's views of advice about falls prevention: A qualitative study. *Health Education Research*, 21(4), 508-517.
- Yardley, L., & Smith, H. (2002). A prospective study of the relationship between feared consequences of falling and avoidance of activity in community-living older people. *Gerontologist*, 42(1), 17-23.
- Yates, S. M., & Dunnagan, T. A. (2001). Evaluating the effectiveness of a home-based fall risk reduction program for rural community-dwelling older adults. *Journals of Gerontology. Series A, Biological Sciences & Medical Sciences*, 56A(4), M226-230.
- Yokokawa, Y., Kai, I., Usui, Y., Kosoda, F., Furuta, T., & Konaka, K. (2003). Intervention study using a fall prevention program to prevent functional decline of old-old elderly in a rural community. *Japanese Journal of Geriatrics*, 40(1), 47-52.

