The development of an intervention to promote Older Peoples' Rehabilitative Exercise Engagement (OPREE).

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Abstract

Introduction

On average only half of patients attend prescribed strength and balance exercise (SBE) programmes. This thesis details the development of an intervention to support exercise programme engagement, and a feasibility study.

Methods

A literature search, interviews and synthesis process enabled the development of an intervention for promoting Older People's Rehabilitative Exercise Engagement (OPREE). A pre and post cohort feasibility study examined the viability of OPREE within an NHS community setting. Patients referred to the SBE classes were invited to participate. A case control group formed the comparison. SBE sessions attended formed the primary outcome. Secondary outcome measures were behaviour change, activities of daily living, functional mobility and quality of life. Interviews measured OPREE's fidelity and acceptability.

Results

OPREE was delivered over four, monthly one hour sessions using a combined strategy. Out of 27 potential patients, ten accepted OPREE. Additionally, 27 patients who only received SBE formed the case control. OPREE intervention participants attended 75% of SBE classes. Control group participants attended 45%. BREQ3 data highlighted large improvements in amotivation and extrinsic regulation (externally driven exercise behaviour, for example to gain praise), medium change in introjection, small changes in identified and intrinsic regulation, and no change in integrated regulation. Activities of daily living and quality of life improved. Eight (80%) of the intervention participants completed all OPREE

sessions. All intervention participants considered OPREE to be acceptable and useful.

Conclusion

It is feasible to deliver OPREE in an NHS setting. The reasons why some patients declined the offer of OPREE needs further exploration. There is evidence that interventions such as OPREE can increase engagement with prescribed exercise; this needs further evaluation.

Acknowledgements

My journey from a clinical therapist to a clinical academic physiotherapist has been one that has blossomed under the tender and patient support and nurturing of Professors Pip Logan and Tash Masud. My PhD journey has not been uneventful. Professors Pip Logan and Tash Masud identified a potential challenge and instigated an investigation. Dr Lisa Rűll then supported me through and beyond my subsequent diagnosis of Dyslexia and Dyspraxia; without this, my PhD journey would have been far more tortuous. Their support and that of because the support mechanisms might not have been emplaced. I would also like to thank Dr Veronika van Der Wardt and Dr Kristian Pollock for their supremely patient, thoughtful and diligent supervision and mentorship in teaching me how to perform and communicate my Doctorate level research. The invaluable friendship and

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Finally, and by no means least, thanks to my long-suffering family, Nicola, Cerys and Ffion. You have trodden every step of this PhD with me. During this work, you released me from weekends, nights and even a summer holiday. My wife, Nicola saw something in me and supported me throughout. Consequently, I gained my very first formal qualifications in my late twenties. She continued to push and sometimes cajoled me through to my Bachelors and then my Masters and ultimately, this final degree. Cerys and Ffion have only known their father as a student; in their own ways, they have been there for me. All three of them have been patient and supportive to a humbling degree. They should (and do) know that this will give them the power of emotional blackmail over me forever.

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Outputs

Peer reviewed publications

No publications have been submitted, but post-doctoral papers are being prepared.

Poster presentations

4th European Congress of the World Confederation of Physical Therapy (2016). Anthony, KE. van der Wardt, V. Robinson, K. Pollock, K. Masud, T. Logan, P. Which physical exercise engagement strategies have been perceived as useful or had a positive effect on exercise engagement in older adults: a systematic review.

www.physiotherapyjournal.com/article/S0031-9406(16)30360-1/fulltext

British Geriatric Society spring conference (2018). Anthony, KE. van der Wardt, V. Pollock, K. Masud, T. Logan, P. The development of an intervention to improve Older Peoples' Rehabilitative Exercise Engagement (OPREE)

Oral presentations

Nottingham CityCare Partnership Research Forum (September 2017): Engaging older people in rehabilitation – results from a feasibility study.

Nottingham CityCare Partnership Community Services Forum (January 2018): Helping Older People to Engage in healthcare.

Glossary

The following terms are frequently used throughout the thesis and therefore a brief definition is provided below.

Behaviour Change Wheel (BCW): a framework that provides developers with a toolkit for intervention design.

Community dwelling: the geographical location that the respondent or participants usually lived.

Complex Intervention: 'an intervention that contains several interacting components, with a range of possible outcomes and/or variability in the target population' (Medical Research Council, 2000).

Effect Size (ES): a method of quantifying the difference between two groups.

Exercise: 'physical activity that is planned, structured, and repetitive for the purpose of conditioning any part of the body. Exercise is used to improve health, maintain fitness and is important as a means of physical rehabilitation' (The Free Medical Dictionary [online], viewed 6th November 2017).

General Practitioner (GP): a doctor based in the community

National Health Service (NHS): the publicly funded national healthcare system in the United Kingdom.

Needs Supportive Communication Strategy: a strategy that provides meaningful choices and rationales, acknowledges negative feelings, offers constructive feedback, and displays a genuine interest in their welfare.

Older Peoples Rehabilitative Exercise Engagement: OPREE

Physical Activity: 'any bodily movement produced by skeletal muscles that requires energy expenditure' (World Health Organisation, viewed 6th November 2017).

Social Cognitive Theory (SCT): an interpersonal level theory that highlights the changing interaction between people, their behaviour, and their environments.

Self Determination Theory (SDT): a theory of motivation that is concerned with supporting our natural or intrinsic tendencies to behave in effective and healthy ways.

Strength and balance exercises (SBE): commonly referred to as 'Postural Stability'. Progressively challenging exercises specifically designed to reduce the risk of sustaining an unintentional fall.

Theory of Planned Behaviour (TPB): a theory that links beliefs with behaviours.

Timed Up and Go (TUG): a test of functional mobility.

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Chapter One: Preface

1.1 Chapter summary

This Chapter outlines the structure of this thesis. This thesis has the setting of a population that is living longer; nonetheless, many older adults do so while coping with challenges to their independence. The National Health Service (NHS) provide physical activity interventions which aim to improve physical function and prevent falls in older adults, however approximately only half of the patients attend these treatments. This thesis, therefore, describes a systematically developed intervention that was designed to improve Older People's Rehabilitative Exercise Engagement (OPREE).

1.2 Thesis aims and questions

The overarching purpose of this project was to improve older people's exercise engagement in the context of a highly evidence-based Strength and Balance Exercise (SBE) programme. More specifically, with the purpose of systematically developing the OPREE intervention, the following objectives and research questions were addressed:

a) To formulate an intervention designed to support Older People's Rehabilitative Exercise Engagement (OPREE).
b) To test the feasibility of delivering OPREE.
c) To guide the further development of OPREE as an intervention.

Chapters two and three addressed the research question:

a. Which theories, strategies and frameworks are most suitable to guide the development of an intervention to increase exercise engagement?

Chapter four addressed the research question:

b. What are the underlying reasons for older adult's sub-optimal long-term exercise engagement?

Chapters four, five, six and seven addressed the research question:

c. What components, techniques or strategies are perceptually acceptable, practical, and useful in an intervention designed to improve older adult's exercise engagement?

Chapter two introduces the study. Chapter three details a systematic review. Chapter four details semi-structured interviews and a focus group. Chapter five synthesised the studies from Chapters two, three and four. Chapter six details a feasibility study, and then Chapter seven discusses the whole thesis with recommendations for future studies.

1.3 The research team

Kevin Anthony (KA) was the Doctoral Student. The primary supervisor was Professor Pip Logan (PL), an Academic Occupational Therapist. Doctor Kristian Pollock is the Principal Research Fellow within the University's Faculty of Medicine and Health Sciences and supported the qualitative arm. Doctor Veronika van der Wardt is an Assistant Professor, also at the Faculty

of Medicine and Health Sciences, and supported the systematic review and quantitative analyses. Professor Tahir Masud is a Consultant Physician at Nottingham University Hospitals NHS Trust and supported the work as an advisory clinical 'critical friend'.

1.4 Personal approach

At the time of writing, I have gained 38 years of healthcare experience. Seventeen years of this have been as a Chartered Physiotherapist where I have predominately worked in the context of older adults' rehabilitation in the community setting. Through this role, I recognised the challenge of supporting older people to engage in structured exercise programmes which formed the basis of the work in this thesis. These challenges are briefly outlined below to describe the development of the work within this thesis.

1.5 Development of the research

Within my role as a Physiotherapist working in Nottingham CityCare's community Rehabilitation service, I am responsible for delivering a progressively challenging strength and balance exercise programme for NHS patients. Within this role, I identified a problem where patients would withdraw from classes but were not followed up. I performed a service audit of older people (n = 31) who had attended the strength and balance programme within the preceding six months. The service audit found that 40% of respondents achieved recommended levels of physical activity (150

minutes of moderate to vigorous physical activity per week) (Department of Health, 2011d). The results also showed a mostly sedentary sample of older people with the majority of respondents repeatedly spending more than 2 hours sitting or lying down during the day (n = 14). The majority of respondents exercised at home and on their own (n = 23), and few respondents accessed group facilities (n = 3). Most frequently cited barriers to exercise participation were health problems (n = 11), low confidence (n = 8), knowledge of available activities or facilities (n = 6), or a lack of someone to go with (n = 4). Nonetheless, several indicated that they enjoyed the classes and wished that they could continue, "not only [for] the exercises but also the company".

This service audit formed the basis of an application to the Master of Arts in Research Methods (MARMs) course. As a part fulfilment of the course, I performed a mixed methods service evaluation (n = 44, 50% female; mean age 81 years; range = 64 to 93 years) under the guidance of PL. The evaluation identified a mean attendance of 54% of 20 available sessions (10.8 sessions; SD 9.6). Identified issues with attending the group exercise sessions were increased frailty (n = 5), referral to another more appropriate service (n = 5), or medical incidents (n = 5) partially accounted for this finding. Other reported reasons included going on holiday, other commitments, or perceptually too busy (n=2). The primary reasons for attending included wanting to improve functional abilities as well as social benefits of participating in a group. The reasons discussed by older people

were different from the primary purpose of the programme which is to reduce falls risk. These interviews highlighted disparities between the view of older people and the views of clinicians. These pieces of preliminary work before the doctoral research identified an issue with older people engaging with structured exercise programmes and highlighted potential barriers and facilitators. Consequently, I considered how we could help patients in the NHS engage with prescribed exercise treatments. These considerations form the basis of this thesis.

Seven Chapters present work that developed and tested the OPREE intervention. Figure 1 presents the thesis structure.

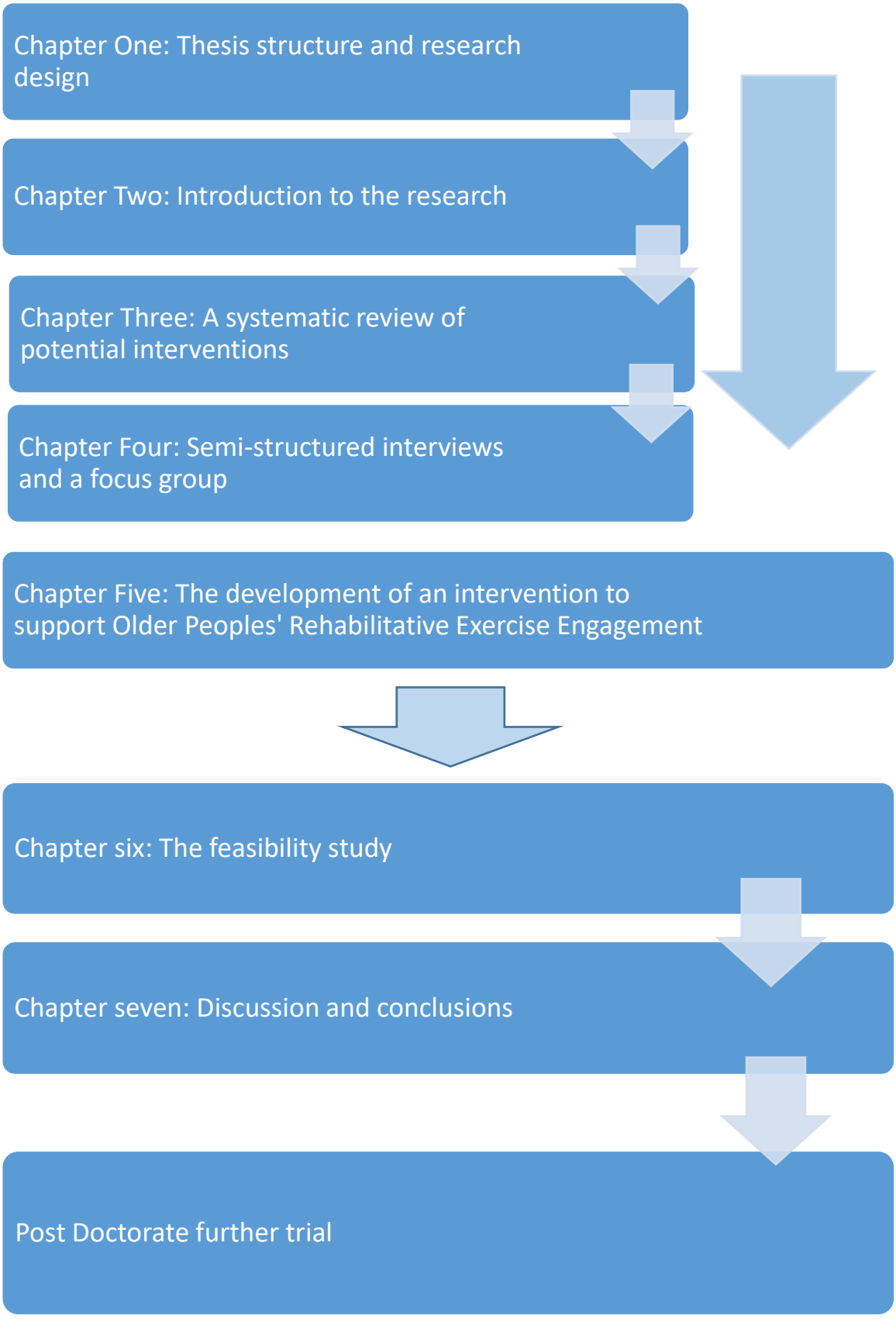


Figure 1: Thesis structure

Chapter Two: Introduction

2.1 Summary

This Chapter outlines a scoping review to accumulate evidence about the issues of an increasing population of older people with complex health needs. The Chapter then explores the benefits of exercise for older people in the context of maintaining independence and the consequences of lack of engagement in exercise or physical activity. An examination of the concept of physical exercise engagement and its associated terminology precedes a discussion of those theories that could be used to underpin an engagement intervention.

2.2 An ageing demographic

Globally, the proportion of people aged 60 years or over is predicted to increase from 11% in 2006 to 22% by 2050 (World Health Organisation, 2016). Until recently the developed western world adopted the age of 65 years as the economic point at which social security (pension) payments could be claimed (United Nations, 2013). Recent health and social care facility improvements (Spirduso et al., 2005) partially account for 10 million people in the UK being over the age of 65 years (Cracknell, 2010). Despite the UK retirement age of 65 years being phased out (Gov.UK, 2016), this thesis accepts the chronological definition of older person as a person aged 65 years or older. In England, life expectancy for men aged 65 years in

2012 to 2014 was 18.8 years, while women at this age could expect to live for 21.2 years. This means that a 65-year-old man could expect to live to almost 84 years, while a woman of the same age could expect to reach her 86th birthday. In Wales, life expectancy for men and women aged 65 years in 2012 to 2014 was 18.2 years and 20.6 years respectively. This means that men and women at this age could expect to live to reach their 83rd and 85th birthday respectively; however, many live independent lifestyles (Office for National statistics, 2016).

While older people's contribution to society through activities such as informal caring or volunteering (Women's Royal Voluntary Service, 2011), is estimated to form a net value of £165 billion (Robertson, 2016), ageing does increase the risk of health problems (Spirduso et al., 2005). Those living with one or more age-related chronic diseases are more likely to require care (Oliver, 2016). The result of these changes means that older people's services account for 51% of local authority social care, and 60% of primary care prescribing spending (Oliver et al., 2014). Where long-term appropriate health behaviours are adopted, noncommunicable diseases including heart disease, cancer, diabetes, stroke and chronic lower respiratory disease can be prevented (World Health Organisation, 2014). Such conditions account for 70% of the UK's annual £120 billion NHS budget and transforming older people's services requires a fundamental shift towards coordinated care that prioritises prevention and support for maintaining independence (Oliver et al., 2014).

Thus, strategic calls for interventions which reduce later life dependency, have increased (Oliver, 2016, NHS England, 2014) because those who consume the most health care, are often sedentary with poor health and lifestyle choices (McNally, 2017). As an example, a systematic review of 47 articles (n = 829,917 participants) demonstrated that repeated and prolonged sedentariness significantly increases mortality risk ($p = 0.001$) (Biswas et al., 2015).

2.3 Benefits of exercising in later life

Inactive lifestyles are a public health concern because they underpin much of the developed world's disease burden (World Health Organisation, 2010). Data estimates that physical inactivity costs the English economy £8.2 billion per year (British Heart Foundation, 2013). Strong evidence also demonstrates that, among individuals of all ages, physical function and perceived quality of life is improved by regular physical activity. This is true for older people, for whom improved physical function not only reduces risk of falls and fall-related injuries but contributes to their ability to maintain independence (Office of disease prevention and health promotion, 2018). The infographic (Public Health England, 2016b) presented in figure 2 illustrates how physical activity reduces the risk of developing many illnesses (Manini and Pahor, 2009, McNally, 2017).

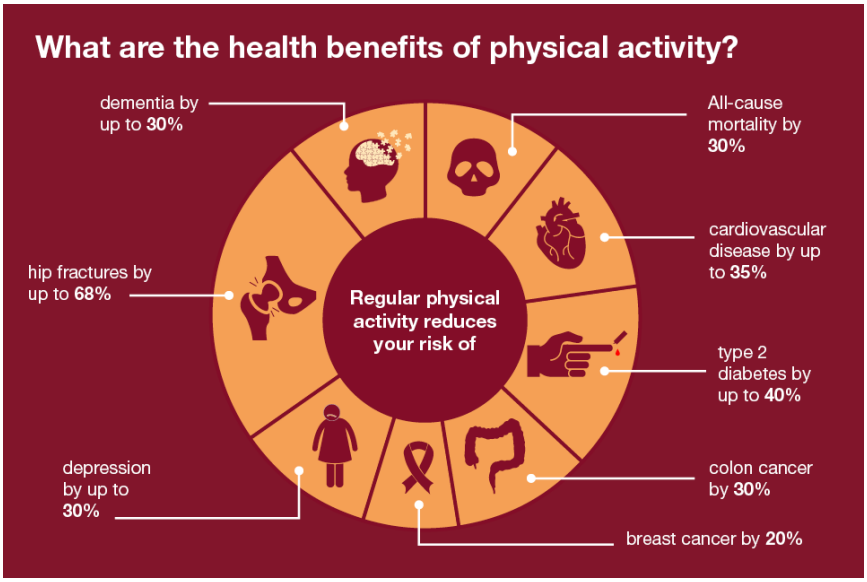


Figure 2: What are the benefits of physical activity?

A systematic review and meta-analysis (9 cohort studies; n = 122,417) indicated that some physical activity participation reduces the risk of developing avoidable illnesses. By participating in moderate to vigorous physical activity for 150 minutes, the risk is reduced by 22%. This risk reduction increases to 28% for participation for more than 150 minutes ($p < 0.0001$) (Hupin et al., 2015).

Many older people have sedentary lifestyles with prolonged periods of sitting and this can lead to functional decline (Spirduso et al., 2005). Metabolism rates reduce by sitting for extended periods of time, which affects the body's ability to regulate blood sugar, blood pressure and break down body fat. Conversely, cellular respiration is improved by aerobic exercise participation (MacArdle et al., 2016), and this increases muscular efficiency (Thomas, 2016), and therefore endurance (MacArdle et al., 2016). Consequently, by combining high-intensity aerobic and resistance

exercise, lean muscle mass improves (Robinson et al., 2017). Notably though, when physical exercise discontinues, high-intensity hypertrophic changes also cease with a potential loss of all gains within 12 weeks (Andersen et al., 2005). With exercise discontinuation, muscle mass reduces which increases the risk of frailty, a common and important geriatric syndrome characterised by age-associated declines in physiologic reserve and function across multi-organ systems, leading to increased vulnerability for adverse health outcomes (Chen et al., 2014).

Thus, the risk of developing avoidable illnesses improves by incrementally increasing physically active lifestyles (Biswas et al., 2015). However, independent of age and other clinical and functional variables, such illnesses exert a significant influence on levels of disability and mortality (Landi et al., 2010). Consequently, by reducing the risk of developing such ailments, the risk of increased morbidity, frailty and cognitive decline is reduced (Rydwik et al., 2013, Wu et al., 2015, Biswas et al., 2015, Hagger and Chatzisarantis, 2005, Department of Health, 2011b). Evidence also suggests that older people's social participation increases in parallel with increased exercise participation, which in turn improves self- esteem and quality of life (Department of Health, 2011b, Biedenweg et al., 2014). Related research has also shown that inclusion within a group exercise programme increases personal autonomy, and consequently, exercise specific self-efficacy (Koudenburg et al., 2017).

2.4 Falls and risk reducing exercise

Approximately 30% of people living in the community aged 65 years or older, and 50% of those aged over 80 years, fall at least once each year (Lord et al., 1993, Todd and Skelton, 2004). Importantly, 20% of falls cause severe injuries, such as fractures or head injury (Sterling et al., 2001). A fall may be defined as "an unexpected event in which the participant comes to rest on the ground, floor, or lower level" (Lamb et al., 2005) (p 1619). Injurious falls among older people are largely preventable but potentially result in increased dependency and prolonged disability. Estimations suggest that falls cost the NHS more than £2.3 billion per year (Lord et al., 2007, National Institute for health and Care Excellence, 2013a, Oliver et al., 2014). With the number of people aged 65 years and over predicted to increase by 2 million by 2021, costs are set to rise further (Tian et al., 2013).

There are over 400 associated risk factors with falling (National Institute for Health and Care Excellence, 2015 (updated 2017)). Significant falls risk factors are classified into three domains (Lord et al., 2007, National Institute for health and Care Excellence, 2013a, Winter et al., 2013):

- Intrinsic (for example, postural instability, sensory and neuromuscular deficits).
- Extrinsic (for example, polypharmacy).
- Environmental (for example, slippery floor surfaces, or lack of handrails in bathrooms or on stairs).

Notably, while complex physiological conditions such as Parkinson's Disease frequently lead to an impaired ability to maintain balance mechanisms, they often cause psychosocial features such as anxiety, depression, and social isolation. In turn, such features lead to a further increased risk of falling (Lord et al., 2007, National Institute for health and Care Excellence, 2013a, Oliver et al., 2014). Therefore, all older people at risk of falling should be offered a multifactorial falls risk assessment and an individualised multifactorial intervention. Importantly, balance impairment and muscle weakness caused by ageing and lack of use are the most prevalent modifiable risk factors for falls. Guidance, therefore, recommends that all older people living in the community should be referred for strength and balance training where there is a known risk of falling or they have a known history of recurrent falls (National Institute for Health and Care Excellence, 2015 (updated 2017)).

2.5 Strength and Balance Exercises

National guidelines strongly advocate Strength and Balance Exercises (SBE) (National Institute for health and Care Excellence, 2013a) for all older people at risk of suffering injurious falls, because such planned, structured, repetitive and purposive exercises significantly reduce the risk of sustaining a fall-related fracture (RR 0.34, 95% CI 0.18 to 0.63; 6 trials; 810 participants) (Gillespie et al., 2012). In addition to SBE, walking training may be included, but high-risk individuals should be excluded from 'brisk

walking' programmes (Sherrington et al., 2016) because they can increase the rate of falls in this population.

The greatest effects of prescribed exercise on falls (RR = 0.58, 95% CI = 0.48–0.69) were obtained from programmes that challenged balance to a high extent and at least three hours per week (Sherrington et al., 2016). Thus, although seen in test conditions, these significant results informed Sherrington and colleagues' recommendation that strength and balance exercises should be ongoing. Their finding was supported by data that suggested that there is a potential loss of all gains within 12 weeks of abstinence from exercise participation (Andersen et al., 2005).

Most NHS and public health SBE programmes, however, have a limited duration, and patients are expected to maintain their exercises after discharge. In the north of England, community-set falls rehabilitation projects have also shown that those patients who are followed up six months after rehabilitation, have not continued with their physiotherapy set exercises and lack further community-based exercise classes. Consequently, they revert to their pre-rehabilitation state with an increased falls risk and functional reduction (Hawley, 2009). A Cochrane systematic review also demonstrated that, on average, 70% of community-dwelling older people were likely to accept the invitation to participate in falls prevention interventions. While short term adherence rates were high, these dropped to half by 12 months (Nyman and Victor, 2012). This finding suggested that participants involved in research studies adhere to the

exercise intervention but do not engage with exercise per se. Nonetheless, variable factors such as recruitment methods, health and population frailty levels, perceived falls risk level, referral source, activity/independence levels and pragmatic service provision differences might considerably affect these rates. In the clinical service evaluation completed prior to this research project by the author, only 55% of patients completed the exercise programme. To understand the significance of this, the study presented in this thesis explored exercise engagement in a falls preventative clinical service, not services provided especially as part of a research project.

In contrast to Nyman and Victor's Cochrane review (2012) of the proportion who accepted the invitation to participate in SBE, Franco and colleagues surveyed community-dwelling older people with a history of falling (n = 220; mean age 68 years) with on-line or face to face questionnaires. The authors found that, despite a firm evidence base (Sherrington et al., 2016) and a personal history of falling or mobility limitation, 54% did not perceive any benefit of attending strength and balance exercise programmes. Notably, evidence suggested that such poor adherence stems from a fatalistic cost benefit trade off (Franco et al., 2016). These findings supported Franco and colleagues' previous findings which found that some older people still believe that physical activity is unnecessary or even potentially harmful (Franco et al., 2015), equally, strength and balance exercises rarely comprise a normal active lifestyle where 19% of men and 12% of women >65 years meet guidelines; this level decreased with increasing age (Strain et al., 2016). Therefore, it is essential that older

adults are positively engaged in evidence-based exercise and, importantly, maintain engagement levels as a falls preventative measure, both during and after rehabilitation (Hawley-Hague et al., 2017). Nevertheless, early evidence suggests that many older people do not wish to spend their last 1,000 days exercising.

Before a discussion of engagement theories, the literature supporting, and outlining the frequency and intensity of exercise levels is presented alongside potential explanations of barriers to such exercise participation.

2.6 Physical activity recommendations

International and national guidelines recommend that all adults (including older people and irrespective of varying stages of health) should participate in 150 minutes of 'moderate to vigorous physical activity' per week in blocks of 30 minutes' (Davies et al., 2011). Despite national and international recommendations, participation remains low. However, men are more likely than women to be physically inactive (sedentary) for at least six hours per day (Public Health England, 2015b). Additionally, research data (DeMaria, 2012, Rydwik et al., 2013, Franco et al., 2015) from USA, Europe and Australia also shows that 57% of men and 79% of women aged 75–84 years fail to achieve optimal levels of moderate to vigorous physical activity.

A systematic review of 22 studies (10 countries and 1 European wide; n = 349,698 adults aged ≥ 60 years) demonstrated that many older people judge themselves to be active when they are not (Harvey et al., 2015). The

findings of this review indicated that many older people perceived themselves as broadly active (5.4 'sedentary' hours: defined as sitting, reclining, or lying down; or by little energy expenditure), but objective measurement (various forms) showed that older adults spend an average of 9.4 hr a day sedentary, equating to 65-80% of their waking day (Harvey et al., 2015). An international advisory working group comprising physical activity experts debated whether higher intensity physical activity recommendations were attainable or appropriate (Bull et al., 2010). Some members suggested that guidelines should promote light intensity activity and lifestyle-related activities, but overall, the expert group did not support this assertion. The suggestion, therefore, supports the promotion of moderate to vigorous activity.

For older people to meet the recommended levels of physical activity, there needs to be an understanding of what is considered moderate and vigorous activity. Various methods exist to define moderate and vigorous physical activity, for example, the 'Metabolic Equivalent of Task', or the 'Physical Activity Ratio' (MacArdle et al., 2016). Arguably, a more useful approach might be the 'talk test'; a test that defines moderate intensity exercise as being able to talk but not sing the words to a song. Vigorous intensity aerobic exercise is evidenced when unable to say more than a few words without pausing for breath (NHS Choices, 2015). Thus, this definition would be more applicable to a frail older person who's exercise tolerance might mean that they quickly become breathless, even during fast walking, and are unable to 'walk two miles in 30 minutes' (Travers, 2015).

2.7 Strength and Balance Exercises

Numerous older people live independent lifestyles, yet injurious falls pose a particular hazard for many. As part of a multi-factorial approach to reducing falls, SBEs are commonly used because of extensive research (Skelton et al., 2005, Gillespie et al., 2012, Lord et al., 2007) and systematic reviews (Gillespie et al., 2012, Sherrington et al., 2016) over some years (Skelton and Dinan, 1999, Skelton et al., 1994). A survey (n = 1,700) further showed such programmes to be intuitively useful (96%), and many (95%) participants were satisfied with their outcome (Royal College of Physicians, 2016). KA has provided both home and group based SBEs for many years. This experience highlighted perceptually high patient withdrawal rates from such classes, and these beliefs were confirmed by evidence provided in Chapter two. Consequently, the danger was that exercises might be discontinued; any pre-intervention falls risk level improvements could be reversed (Skelton et al., 2005). This finding stresses the importance of long-term exercise engagement.

Research has determined over several years, that participation in a weekly group exercise programme with ancillary home exercises can improve balance and reduce the rate of falling in at-risk community dwelling older people (Barnett et al., 2003). Additionally, social psychologists hold that membership of a group mediates adherence (Hagger and Chatzisarantis, 2005, Jekauc, 2015, Deci and Ryan, 2002b). The Nottingham SBE classes were based on research studies which emphasised that a recommended

minimum ‘dose’ of 50 hours exercise (Sherrington et al., 2008) was needed to have an impact on the rates of falling. Consequently, participants were encouraged to exercise for one hour per week in a group, and twice weekly at home. While, it is recognised that there is no point where the ‘habit’ of exercising ends, there is evidence that many older people complete a rehabilitative such as an SBE programme and then revert to a sedentary lifestyle (Chao et al., 2000).

A comparison of an SBE programme delivered as a group, called the Falls Management Exercise (FaME) programme, with the home-based Otago Exercise Programme (OEP) occurred in a large (n = 1,256) six-month RCT (Iliffe et al., 2014) where usual care formed the case control. The FaME participants’ self-reported moderate physical activity levels significantly increased one year after the intervention finished. Conversely, the OEP participants were no more likely to have increased their activity compared to the control group. The authors suggested that peer mentor recruitment issues and a lack of specialist training may have diluted the OEP home support component of the intervention. Equally, in the OEP study, peer mentors might not have perceived themselves able to modify or change the SBEs accordingly so that they were sufficiently challenging to the particular person to keep them interested. Therefore, it would appear that for any SBE programme to be successful, staff or peer mentors require adequate training to the level that they can adapt programmes accordingly and the SBEs need to be delivered in a group.

In conclusion, international literature recommends that older people should exercise for 150 minutes per week, which can be spread over five sessions of 30 minutes, and those at risk of falling should include three hours per week performing SBEs. However, it has been recognised that this might be difficult to attain for some older people, and the literature indicates that helping people engage with exercise is complex. The next section will consider the various factors that might influence exercise engagement.

2.8 Health literacy

To assist older people to engage in exercise for health maintenance or improvement, it is beneficial for stakeholders to understand the concept of health literacy. A Royal College of General Practitioners led workshop defined health literacy skills to be:

"The cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use information in ways which promote and maintain good health."

(Nutbeam, 2008) (p 2073).

Health illiteracy often arises because of low qualification levels and low job status, limited English as a first language, and those in the poverty trap (Rowlands et al., 2014). As an example, a survey of working age people suggested that approximately 43% lack the ability to understand written health information (Department for Business Innovation and Skills, 2012),

and with the inclusion of numerical information, this rises to 61% (Rowlands et al., 2015b). Poor health literacy within a population results in a substantially higher prevalence of physical and mental health conditions because the population affected often fail to access appropriate services (Berkman et al., 2011). Such findings support the inverse care law (Tudor-Hart, 1971) which holds that those who are less able to access and use services to support healthy lifestyle choices are those who are less able to afford the effects of unhealthy choices (Oxman, 2016). Furthermore, older people who do not access SBE training but would most benefit from it, are those most likely to be health illiterate (Rowlands et al., 2014). The indication therefore is that low health literacy increases the risk of premature mortality (Bostock and Steptoe, 2012); health professionals thus require an understanding of reasons for behaviours.

2.7.1 Learned health behaviours

Social Cognitive Theory (SCT) proposes that people learn new behaviours through repetition, but also the replication of other peoples' actions. The theory holds six constructs that stresses the importance of dynamic and reciprocal interactions, capability, social learning, expectations and self-efficacy (Wallace et al., 2000). As examples, social networks have been shown to influence physical activity levels across diverse populations (Rovniak et al., 2013). An extensive study from two national cohorts, covering 20 British towns, and involving nearly 1,500 older people

established that, in the promotion of physical activity levels, social interactions are more influential than the physical environment (Hawkesworth et al., 2017), yet study data detailed low exercise programme completion rates, arguably because of low health literacy. Finally, 38 exercise professionals who delivered exercise on prescription took part in semi-structured interviews (Moore et al., 2011a). The authors concluded that, given various health conditions, interventions should meet the participant's interpersonal support needs, incorporate activities that internalise exercise behaviour and provide advice on safe exercise. Furthermore, the authors asserted the need to investigate the effectiveness of fostering long-term social networks through maintenance classes after NHS exercise programmes.

2.9 Concepts of exercise engagement

The terms compliance, adherence, and engagement are used interchangeably in exercise research and without explanation, but it is important to reflect and contextualise their meaning. Table 1 summarises the differences between compliance, adherence, concordance and engagement. In practice though, compliance, adherence and even concordance are used interchangeably. The concept of 'compliance' initially became established within pharmaceutical research, where it implied a temporary regard for expert advice. Most of the dialogue was about non-compliance, or 'deviant' disregard for 'expert opinion' (Horne et al., 2005).

For example, patients were seen to be compliant if, without questioning, they took all their medication as prescribed by the doctor, and vice versa. The term 'compliance', therefore, reflects directly on those behaviours exhibited by the patient or participant. Exercise 'adherence' on the other hand, is influenced by an equal understanding of patient and healthcare professional responsibilities (Foot et al., 2014).

Table 1: Compliance, adherence, concordance and engagement

	Compliance	Adherence	Concordance	Engagement
Dictionary definition	The act of obeying an order, rule, or request.	The act of behaving exactly according to rules, beliefs, etc.	The act of agreement or consistency	An arrangement to do something or go somewhere at a fixed time.
Health definition	The act of 'matching the prescriber's recommendations' (Horne et al., 2005).	The extent of consistency of a given person's behaviour to that of health care recommendations (Dunbar-Jacob and Mortimer-Stephens., 2001).	The achievement of a therapeutic alliance and negotiation between the prescriber and the patient (Jordan et al., 2002).	The actions individuals must take to obtain the greatest benefit from the health care services available to them (Centre for advancing health, 2009).
Components	Linear, paternalistic and dichotomous. Non-compliance ascribed as 'deviant.' (Ezzat et al., 2015)	Continuous, subjective variable, and difficult to accurately define. Might be wholly or partially adherent (DeMaria, 2012).	Shared decision making with the belief that the patient's preferences, rather than the physician's, should dictate disease management (Jordan et al., 2002)	Acknowledges interacting values, attitudes and beliefs (Centre for advancing health, 2009). Transcends temporary regard for 'expert advice' (Pollock, 2005)

Adherence is not dichotomous, it is continuous, subjective and variable (DeMaria, 2012). For example, an older person might consider themselves to be wholly adherent to an exercise programme because they attend the class. However, the same person might suffer a variable health condition that results in their partial adherence to the exercises themselves. Literature reviews also show that the lowest levels of 'adherence' are most often reported for patients with chronic conditions and patients undergoing treatments that require maintenance of behavioural and lifestyle changes (Kirby et al., 2014).

A longitudinal (24 months) qualitative study (n = 30, age range 70 to 85 years) explored predictors of adherence to medication for the prevention of osteoporosis (Salter et al., 2014). Salter and colleagues found that adherence levels varied over time. Among the six core themes which influenced participants' perceptions and motivations to persistently take their prescribed medication were an understanding of adherence and non-adherence, the appraisal and prioritisation of risk, and the anticipation and management of side effects. Notably, the researchers also postulated that, by engaging with supportive professionals, the ability of participants to minimise such barriers increased.

A model of patients as 'reasoned decision makers' holds that patients take an active role in monitoring their health and treatment, and experiment with what seems most useful (Donovan and Blake, 1992). Such usefulness is appraised within a general concern to avoid side effects, the stigma of

illness and treatment, and to manage treatment in such a way as to maximise the ability to carry on with valued social roles and relationships. Therefore, patient's knowledge, understanding and what they most value in their daily lives, needs to be understood if they are to comply with interventions. Lay and professional agendas may, however, significantly contrast, or even conflict. Rather than an expectation of 'compliance', concordance serves as a model of engagement which enables mutual understanding and negotiation.

Thus, communication between the healthcare provider and the patient significantly positively correlates with patient adherence; those providers who are poor communicators hold a 19% higher risk of nonadherence than those who communicate the rationale for exercising well (Zolnierek and Dimatteo, 2009). Such communication potentially reduces the risk of "total or partial" non-compliance (DeMaria, 2012) which might be unintentional (Jin et al., 2008). Further, a narrative literature synthesis identified little consensus between studies on how adherence should be defined, approached and measured, for example, attendance, duration and intensity (Hawley-Hague et al., 2016).

While acknowledging that patients might adhere to therapy, concordance also holds that engagement might not automatically result from simple education about the benefits of exercise (Tulloch, 2005). Low health literacy is associated with low concordance and self- management of illness and overall health status (Greenhalgh, 2015). However, concordance is not

necessarily about increasing compliance, more a different way of understanding patients. Therefore, collaboration between the patient and the professional is required to increase concordance levels. For example, where a Physiotherapist recommends an exercise programme that might increase the level of painful arthritic knees, adherence might reduce. Conversely, such adherence increases when patients are fully involved in the decision-making process (Lequerica and Kortte, 2010).

First used in the context of business and employment in the 1990s, the term 'engagement' has no single definition. Managers now acknowledge that increased efficiency and productivity is possible where the workforce is engaged, absorbed and dedicated to something enjoyable (Markos and Visakhapatnam, 2010). However, those predictors of engagement elucidated in younger adults might not be accurate or sufficient in elderly populations (Schutzer and Graves, 2004). Older people's exercise engagement might be improved by good primary education (Rowlands et al., 2015b), awareness of facilities, low attendance costs, or ease of transportation (Wocken and Talley, 2013). Also, a misperception of taking optimal exercise levels, poor motivation to exercise, or a perception of poor health (Rhodes et al., 1999, Biedenweg et al., 2014) might impede such engagement.

These findings demonstrate the benefits of engaging older people in the decision-making process (Lequerica and Kortte, 2010), and exercise providers should facilitate health and exercise literacy by reducing patient

and professional barriers (Rowlands et al., 2014). Having considered the variable influences of compliance, adherence, concordance, and engagement on SBE attendance, the theories, concept and context of engagement were appropriate for this thesis. Engagement strategies will now be discussed.

2.10 Population-based strategies to increase exercise engagement

In 2009, Mummery and Brown completed a study in three worldwide communities (n = 536,620) which sought to improve physical activity. The researchers proposed six main strategies to increase a population's participation in physical activity (Mummery and Brown, 2009):

1. Social marketing through local mass media.
2. Posters, information booklets or websites.
3. Individual healthcare professional counselling and physical activity prescriptions.
4. Specific voluntary sector groups or sports clubs.
5. Specific working with schools, workplaces, or age care centres.
6. Environmental changes.

While whole community approaches offer tremendous potential for developing sustained social and cultural change toward physical activity (Mummery and Brown, 2009), they are unlikely to be useful at the personalised level. Emphasising this point, conceived in the 1990s, the UK's

Exercise Referral Scheme facilitated participants to embrace healthy lifestyles with free or subsidised programmes (Browne, 1997). Effectiveness reviews have been contradictory. One systematic review (Williams et al., 2007) included eighteen studies and reported that, for one inactive person to become moderately active, the exercise referral scheme required 17 referrals. Equally, a further systematic review found evidence that the strategy was potentially cost effective and resulted in long-term physical activity increasing behaviour (Muller-Riemenschneider et al., 2009). Importantly, no motivational engagement strategies were reported.

Separately, Flannery and colleagues evaluated the programme (n = 2,505 participants; range 18-94 years; modal age= 66 years) (Flannery et al., 2014), and suggested that signposting people to existing physical activity opportunities could facilitate the normalisation of physical activity into daily lives and thereby improve motivational levels.

2.11 Behaviour change theories

The next section explores some of the theoretical concepts used to describe older peoples' exercise engagement. In the design of strategies to promote healthy behaviours, there have been consistent calls for interventions that are researched and developed to be more theory-based (Kahn et al., 2002, Michie et al., 2007). A number of different theories were considered, nevertheless, a continually developing knowledge base has reduced the consensus about the best model or framework (Flowers et al., 2017).

Much research has identified factors that influence exercise engagement. Such studies have primarily focussed on younger adults, but many older people live with co-morbidity, and this means that interventions designed for younger people might not be useful for them. Increasingly, therefore, theoretically underpinned interventions need to reflect the needs and characteristics of older people (Lequerica and Kortte, 2010, Gurung, 2010). While a significant ($p = 0.001$) positive correlation with high adherence levels (Bonnefoy et al., 2012) suggests that new interventions should target those with good baseline functional levels, the challenge is to improve engagement of those harder to reach or motivate older people. Behaviour change techniques should be unique to the person, beliefs, attitudes, culture, and behaviour (Michie, 2014). Research findings also suggest that the effectiveness of behaviour change interventions can be improved when delivered by trained health professionals and carers who are engaged in the intervention (Bonnefoy et al., 2012, Langer et al., 2014, Li et al., 2014).

Existing theories help to explain why some people engage in physical activity and some do not. In 2014, there were at least 93 theories of behaviour change (Michie et al., 2014, Michie et al., 2013b). Many of these techniques such as 'reward and threat' or 'counter conditioning', were inappropriate for this thesis because they are not appropriate for older people (French et al., 2014a). As a whole, Behaviour Change Techniques (BCTs) are defined as:

"Observable, replicable, and irreducible components of an intervention designed to alter or redirect causal processes that regulate behaviour"

(Michie et al., 2013a) (p.82).

The scoping review highlighted three potential techniques that had the potential to enable an understanding of older peoples' culture (French et al., 2012), preferences, values, attitudes, and norms (Darnton, 2008) that influence their ability to engage in exercise, motivational segmentation, the Behaviour Change Wheel (BCW), and the Self Determination Theory (SDT). This next section discusses each in turn.

2.11.1 Motivational Segmentation

The framework of motivational segmentation enables an understanding of those competing priorities (Centre for Ageing Better, 2017) that influence older people's level of exercise engagement. During the model's formation, 52 focus groups and 45 in-depth immersion interviews were performed (n = 4,928; age range 16 to 74 years). Five segments which identified various health behaviours and attitudes were derived: Health Conscious Realists; Balanced Compensators; Hedonistic Immortals; Live for Todays and Unconfident Fatalists (Department of Health, 2010a, Department of Health, 2011c). Segmentation asserts that, common among older people, 'unconfident fatalists' and 'live for todays' are both fatalistic about health choices, tend to live in areas of high deprivation, exhibit the most negative health behaviours, hold negative perceptions of a healthy lifestyle and are

often fatalistic about their health (Department of Health, 2010a). Having low levels of motivation, 'unconfident fatalists' are either 'surviving' with their condition or 'disengaged' from services which provide health care (The King's Fund, 2013, Department of Health, 2010b). Such data suggest that socioeconomic factors drive changeable attitudes, and interventions designed to improve exercise engagement need to target these (Robinson, 2012, Department of Health, 2011a).

The framework adopts the stance that exercise engagement differences result from experiences (nurture). Critics, however, assert that genetic influences control such behavioural differences (nature) (Chamorro-Premuzic, 2015). However, engagement with exercise is influenced by previous experiences, emotionality and cognition, life events, or socioeconomic factors (Belfer, 2013). Nonetheless, research (Kay et al., 2013) suggests that both nature and nurture influence older peoples' exercise engagement. Thus, any intervention to increase exercise engagement should consider such competing yet changeable factors. Further, academic debates were encouraged during the Doctoral training programme; these highlighted that the framework remains controversial, perceptually inflexible, and thus unlikely to be implemented in clinical practice. Therefore, Segmentation was inappropriate for this thesis.

2.11.2 The Behaviour Change Wheel

The Behaviour Change Wheel (BCW) (Michie et al., 2011), designed in the context of health related behaviour change interventions and policies, was considered as part of OPREE because it had the potential to design highly personalised components. The BCW incorporates three domains which impact upon behaviours. (Lequerica and Kortte, 2010) and is shown in figure 3. The inner segment focusses on the capability to physically or psychologically engage in exercise, those social or physical opportunities that facilitate exercise, and the motivation (reflective or automatic) to do so. The middle-segment focuses on the function of an intervention (education, persuasion, coercion, training, or enablement). The outer section concentrates on policy categories (guidelines, service provision).

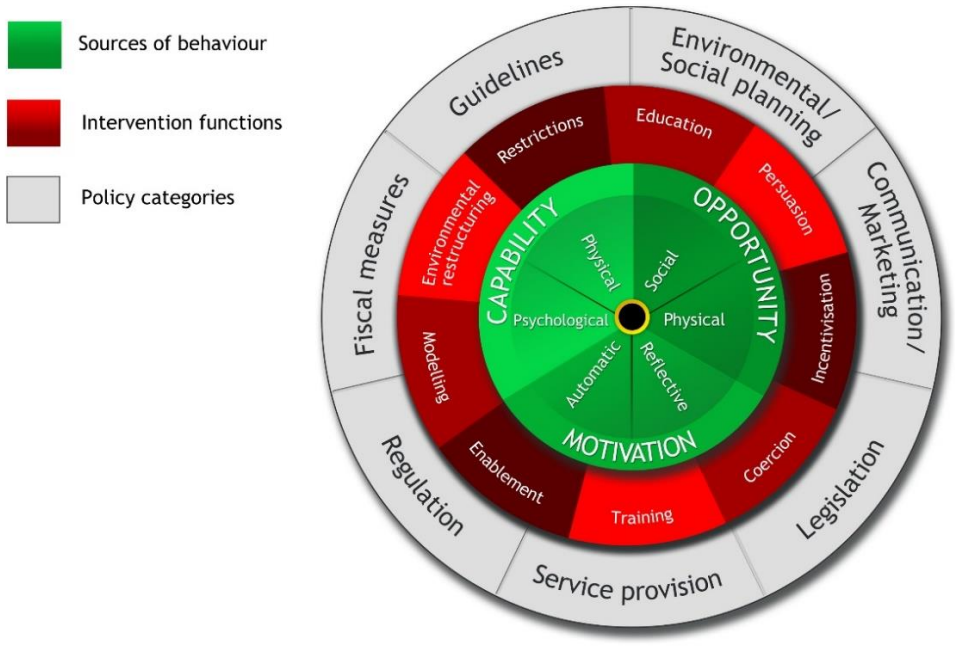


Figure 3: The COM-B system and Behaviour Change Wheel

The theoretically derived framework utilises and integrates the strengths of several models, fuses theory and evidence, and addresses practical issues (French et al., 2012, Michie et al., 2011, Michie et al., 2013b, Prestwich et al., 2014). The framework's developers proposed that perceived capability, opportunity, and motivation influence health behaviours. Capability refers to individual psychological and physical capacity to engage in the activity. Opportunity refers to the external factors that make the behaviour possible or prompt it. Motivation relates to the cognitive processes that energise and direct behaviour (automatic processes, emotional responding, and decision-making). The framework aids the formation of interventions by first understanding the meanings of behaviours at the individual, segmental or organisational level. The authors propose that effective BCTs are then formed by understanding influential factors and then synthesising them into the Theoretical Domains Framework (Michie et al., 2014) that is adapted and illustrated in table 2.

Table 2: Theoretical Domains Framework

Knowledge	Identity
Skills	Beliefs about capabilities
Memory	Optimism
Attention and decision making processes	Beliefs about consequences
Behavioural regulation	Intentions
Social	Goals
Professional role	Reinforcement

The framework is considered to be comprehensive in its range of potential behaviour change mediators with the possibility of designing healthcare enhancing interventions (Francis et al., 2012). The BCW has been used in various settings such as the investigation of barriers and facilitators to healthy pregnancies among women living in poverty (Grant et al., 2017) or the prevention and treatment of sepsis in hospital (Carey, 2016). However, while the domains of the BCW were considered in the intervention development, it could not be used as a theoretical basis for the intervention. The BCW holds features similar to the Self-Determination Theory, a broad framework for the study of human motivation and personality that represents one of the most comprehensive attempts at modelling behaviour change processes (Livingstone and Gaffney, 2016a).

2.11.3 Self-Determination Theory

Self-Determination Theory integrated other theories of motivation and focuses on how social and cultural factors influence the quality of engagement with health behaviours (Deci and Ryan, 2002a). The theory enables an explanation of exercise engagement or disengagement by understanding peoples' desire to grow, their psychological needs, and the sociocultural conditions. One of the first attempts to understand behaviour change, Maslow's hierarchy of needs model (Maslow, 1943), directly influenced the formation of SDT with its acknowledgement that distinctly separate beliefs and behaviours facilitate exercise engagement (Deci and

Ryan, 2002b, Livingstone and Gaffney, 2016a). Also incorporated within the theory and influential in the promotion of exercise engagement, is self-efficacy, the personal belief in the level of ability to succeed in specific situations or accomplish a task (Bandura, 1997). Situationally specific, self-efficacy is highly variable, requires the capacity to self-regulate various competing demands, but does not form an exercise engagement strategy *per se* (Williams and French, 2011, Bandura, 1997). Therefore, strategies which are attentive to the scope of self-efficacy can improve physical exercise engagement (Ashford et al., 2010).

The concept that a sense of group belonging with mutual learning improves personal self-efficacy (Bandura, 1995) was expanded by Deci and Ryan (2002). Depending on the instructor's ability to promote group self-efficacy (Bray and Cowand, 2004), positive health and wellbeing outcomes, exercise specific self-efficacy, and personal autonomy can improve (Koudenburg et al., 2017). The challenge though is to reduce individual dependence upon the instructor (Bandura, 1997, Deci and Ryan, 2002b). As an example, an instructor might use verbal persuasion or vicarious experience (Biddle et al., 2001), but these need to be particular to the activity (Ashford et al., 2010) and person.

To explore this example further, many older people lack the perception that exercise can change their physical abilities because of painful degenerative knee joints (Ryan and Connell, 1989). While interventions might be effective in younger participants, such a perception of a lack of control over

the pain means that similar interventions might be effective if they were adhered to, but the short term pain that they cause reduces the likelihood of adherence (French et al., 2014b). Consequently, it was recognised that an exercise engagement intervention needed to incorporate more useful strategies that involved highlighting the potential benefits of exercise, or help with action planning, or by providing progress feedback (Williams and French, 2011).

2.11.3.3 Self-determination theory components

SDT (Deci and Ryan, 2002b) is a macro-theory that was formed from four mini-theories (presented in table 3).

Table 3: SDT mini-theories

Theory	**Emphasis**
Basic needs theory	Focuses on the core desire for autonomy, competence and relatedness.
Cognitive evaluation theory	Explains how external factors (for example, enjoyment of the class camaraderie), improve or hinder (for example, joint pain) the motivation to engage in exercise.
Organismic integration theory	Emphasises extrinsic motivational processes and internalisation of exercise behaviour.
Causality orientations theory	Refers to the way people regulate their behaviour when considering their environment and the extent of self-determination.

Three principal components are incorporated: autonomy, competence and relatedness (Deci and Ryan, 2002a); table 4 presents these.

Table 4: Components of Self Determination Theory

Autonomy	Refers to the perception that personal actions accord with individual interests, values, and goals.
Competence	Relates to the perception of effectiveness within personal environmental interactions with the ability to meet presented challenges.
Relatedness	Refers to the feeling of connectedness that one is valued, cared for, and loved by those around them.

Separate research (Duda et al., 2014) has suggested that exercise programmes which improve perceived autonomy, competence, and relatedness, form favourable changes in basic need satisfaction and, therefore adherence. The motivation to exercise is likely to be high because the reason and method of exercise engagement is clear (Teixeira et al., 2012). SDT's core constructs hold that sociocultural influences affect older people's perceived ability to increase their physical activity levels safely (Reeve et al., 2004). Therefore, new ways of working which facilitate a positional movement toward intrinsic motivation (Biddle and Mutrie, 2008) by changing attitudes, subjective norms and perceptions of control (Ajzen, 2015) are required.

A central component of self-determination theory it that interventions seek to increase levels of specific intrinsic, versus extrinsic motivation (Ryan and Deci, 2000). Extrinsic and intrinsic motivations differ in that they are regulated differently (figure 4).

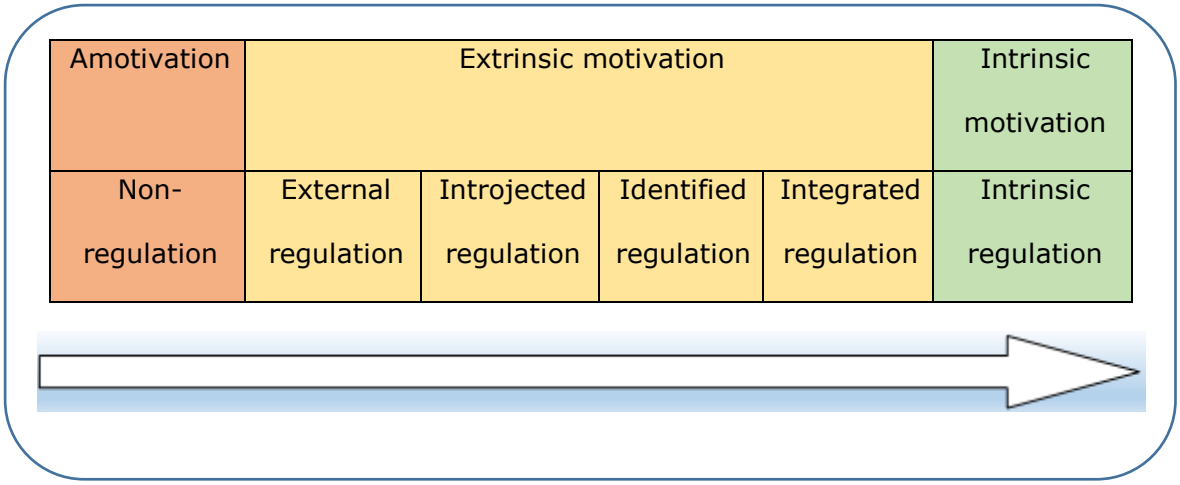


Figure 4: The continuum of behaviour regulation

Table 5 details the components of exercise regulation (Deci and Ryan, 2002a, Ryan et al., 2009a). Autonomy can be supported by encouraging physical activity through signposting to tailored programmes such as walking schemes older people's independence, mental well-being and physical health (National Insititute for Clinical Excellence, 2016). Widely acknowledged, optimal long-term exercise engagement requires a change from an absence of motivation (amotivation), to intrinsically driven behaviours where the person values the health benefits of exercise. However, evidence also suggests that many older people's exercise engagement is regulated by introjection, or for an identified reason such as coping with ailments, and this thwarts intrinsic motivation to exercise (Grant, 2001). Such developmental change is not necessarily linear, and because the person might judge themselves incompetent in the performance of exercise, an event such as a near fall during an exercise

class might potentially reverse any improved exercise internalisation (Ryan and Deci, 2000).

Table 5: Behaviour regulation

Domain	Descriptor	Detail
Amotivation	Least autonomous state of passive action, or even no intention to act.	Often results from the fatalistic perception of inability to change or achieve outcomes.
External regulation	Least autonomous type of extrinsic motivation and apparent when external or social demands form a reason to exercise.	Externally regulated older people often perceive the reason to exercise as external (family pressures, health related demands).
Introjection	Occurs where a therapist's belief in the value of strength and balance exercises is accepted but not identified with personal values, beliefs or normal behaviours.	Short term exercise adherence but not long term engagement.
Identified behaviour regulation	A more self-determined form of extrinsic motivation. Involves a more conscious value of the goal of exercise	A major component of the process toward intrinsic motivation.
Integrated behaviour regulation	Forms basis for a most autonomous form of extrinsically motivated exercise behaviour.	Occurs when values and goals of exercise match personal values, beliefs and goals.
Intrinsic behaviour regulation	Internalised behaviours that emanate from inherent interest and enjoyment of exercise.	The only form of behaviour regulation that an internalised reason to exercise forms.

Figure 5 adapts and illustrates this continuum (Ryan and Deci, 2000). Extrinsic motivations result in behaviours for reward or a fear of punishment. Intrinsic motivations result in behaviours for the enjoyment or interest of the action itself, or because they value the outcome (Ryan et al., 2009b, Ryan and Deci, 2000).

Deci and Ryan (2002) also offered an action-theoretical model (figure 6) of exercise's motivation.

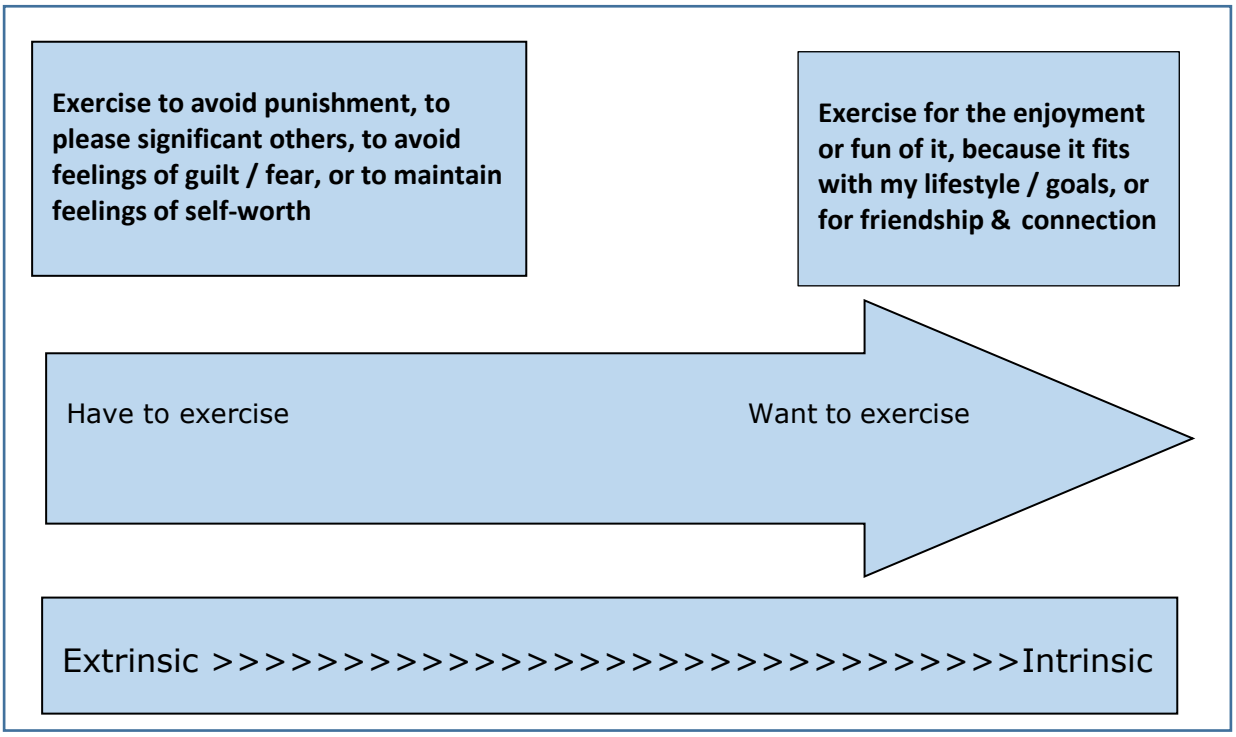


Figure 5: Extrinsic versus intrinsic behaviour regulation

One study identified within the scoping review (Langer et al., 2014) served as an example of how OPREE could map SDT's critical features and reflected the fundamental principles by utilising a broad spectrum of evaluative (Rutter et al., 2017) and interventional methods. These included consistently positively framed messages, continued monitoring and attentive feedback which combined psychological, physical and social support (Stonerock and Blumenthal, 2016).

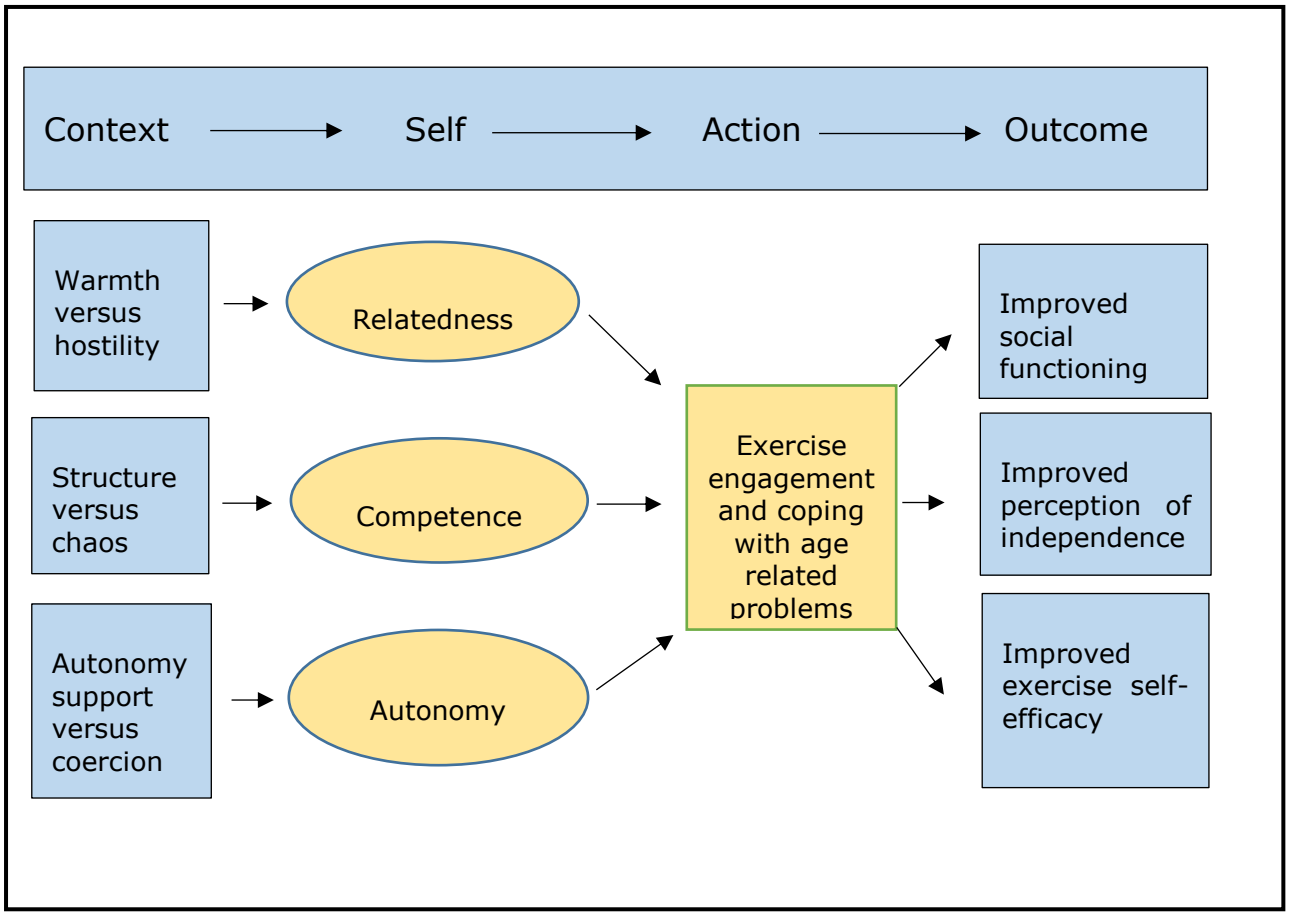


Figure 6: A motivational model

Various researchers have utilised the concept of SDT including dental hygiene (Munster and Halvari, 2006), weight management (Silva et al., 2008), and tobacco cessation (Williams et al., 2006). Alongside preparatory work that enabled the formation of OPREE, these findings emphasised the role of social psychology. For instance, intertwining reasons such as self-esteem, satisfaction with life, and vitality account for unpredictable exercise adherence (Wilson et al., 2008, Ntoumanis et al., 2017). Participants, therefore, needed to become engaged with exercise through an enhanced sense of autonomous and competent exercise performance (Ntoumanis et al., 2017).

The following suggestion was that a supportive and cohesive group could enhance participants' perceived competence to exercise (Marks et al., 2015), but work previously performed by the author demonstrated reduced SBE adherence rates. SDT postulated that active, goal-directed, flexible, constructive persistent, focused interactions with the social and physical environments, could increase these rates (Deci and Ryan, 2002). Nevertheless, while SDT was very suitable for this thesis, it did not provide specific interventional techniques. The Needs Supportive Communication Strategy (NSCS) offered a naturalistic approach that that was derived from SDT and therefore supported all three domains.

2.11.3.4 Needs Supportive Communication Strategy

The strategy enables acknowledgement of negative feelings toward exercise, provided constructive feedback and displayed a genuine interest in participant's welfare (Ntoumanis et al., 2018). Deci and Ryan held that a healthcare professional's chosen communication style can either satisfy or undermine older peoples' exercise engagement (Deci and Ryan, 2000). A needs supportive style is offered where meaningful choices and rationales and negative feelings are acknowledged and supported through constructive feedback with a genuine interest in the person's welfare (Ntoumanis et al., 2018). Conversely, when a professional uses guilt-inducing or pressurising language, trivialises feeling and opinions, or offers prescriptions without collaboration, so adherence reduces. Originally

thought as bipolar (Deci et al., 1981), more recent work methods emphasised the flexibility of adopting either style dependent upon the circumstances (Bartholomew et al., 2009). Table 6 summarises the strategies (Ntoumanis et al., 2018, Patrick and Williams, 2012).

Table 6: Needs Supportive Communication Style

Domain	Communication style
Autonomy-supportive behaviours	Elicit and acknowledge the patient's perspectives and emotions before making recommendations.
Competence support	Be positive about the person's ability to succeed. Reframe past failures as small successes. Identify barriers and solve the problems. Agree appropriately challenging plans.
Relatedness support	Provide unconditional positive regard in a consistently warm interpersonal environment with genuine empathy for the person's concerns.

Evidence indicated that communication which supports patients' psychological needs can lead to better outcomes but is often unused. However, a randomised trial examined the effects of communication skills training on physiotherapists' (n = 24) supportive behaviour for patients (n=24) with chronic low back pain. Those physiotherapists who completed the NSCS training provided greater support for patients' needs (Murray et al., 2015). Importantly, the NSCS is consistent with informed decision-making (Woolf et al., 2005), healthcare professionalism (European

Federation of Internal Medicine, 2002), and is ethical (Cuthbert and Quallington, 2017).

2.12 Chapter Summary

Physical inactivity represents a challenge to a healthy and independent older age. Physical, psychological and social barriers may prevent older people's engagement in optimal physical activity levels. SBEs have been demonstrated to be successful at reducing falls and are included in national guidelines for NHS multi-factorial falls preventative interventions, but research has shown that older people find this difficult to achieve the recommended frequency and intensity of targeted exercise.

This Chapter developed previous work toward OPREE and explored reasons for such behaviour and strategies. Theories and frameworks to increase physical exercise engagement were explored, and both the BCW and SDT were considered. In particular, exercise engagement is improved by different motivational opportunities that fulfil these basic psychological needs of autonomy, competence, and relatedness. Membership of a long-term cohesive exercise group supports such engagement. Interventions should assist the management of a significant hidden condition, such as pain. Appropriate signposting to other services has the potential to facilitate the normalisation of physical activity into daily lives and thereby improve motivational levels. Chapter three details a systematic review of potential interventions.

Chapter Three: A systematic review of strategies for engaging older people in exercise

3.1 Summary

This systematic review aimed to identify components of interventions that seek to improve exercise engagement in an older adult population. Searched databases from their inception to November 2015 were PubMed, Medline, Psychinfo, EMBase, and AMED. Study eligibility criteria included primary research investigating engagement support strategies for community based exercise programmes, with participants who were 65 years and over, published in a peer-reviewed journal. All studies underwent quality appraisal with the use of two tools: The Critical Appraisal Skills Programme and The Mixed Methods Appraisal Tool.

Eight studies evaluating community based exercise engagement strategies were identified. The most promising interventions identified were those that utilised the theories of positive messaging, provided regular monitoring and feedback, offered home visits, were attentive to self-efficacy, were targeted and individualised, offered signposting to appropriate resources, and used behavioural change techniques.

3.2 Introduction

The previous Chapter emphasised that inactivity in older people can be personally detrimental as well as costly to society and that clinical guidance strongly recommends the completion of 'moderate to vigorous physical activity' for at least 150 minutes per week (Garber et al., 2011). Demonstrably, the benefits of engagement in moderate intensity exercise are far-reaching and have benefits other than better physical health. Many older people, though, report such guidance as being either impractical and difficult to meet (Grant, 2001, IpsosMori, 2015).

While these factors are established, very little research has determined how to best design an evidence-based, long-term, physical exercise programme, which older people will follow. While interacting social, psychological, and physical impacting domains are cited in studies of younger adults, these ideas have not been applied to older people's exercise engagement. As an example, a systematic review of studies which only recruited young adults, (Peek et al., 2016) found that activity monitors, feedback systems, written exercise instructions, behavioural exercise programmes with booster sessions, and goal setting significantly improved exercise self-management. However, this limited evidence of potential interventions cannot be applied automatically to older people's needs. This review is warranted because new research studies should not be carried out before a systematic review of existing evidence has been undertaken (Lund et al., 2016).

3.3 Objectives

The objective of this systematic review was to investigate the research question:

Which physical exercise engagement strategies were useful or had a positive impact on exercise engagement in older people?

3.4 Method

3.4.1 Protocol and registration

This systematic review is reported in line with recommended guidelines (Shamseer et al., 2015), and was registered with PROSPERO: the Prospective Register of Systematic Reviews: Available at Appendix A and accessible at:

http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42016030155.

3.4.2 Eligibility criteria

This review used the following eligibility criteria to select studies for inclusion or exclusion.

3.4.3 Inclusion criteria

- Studies which recruited participants who were 65 years of age and over; or where the mean and standard deviations indicated that the majority of participants were 65 years and over. No upper age limit was applied.
- Studies which described and evaluated community based exercise engagement improving strategies.
- Studies where the primary outcome was improved exercise engagement, operationalised as adherence.
- Studies published in peer-reviewed journals including randomised controlled trials, cohort studies, cross-sectional studies, case-control studies, case studies, or interview or focus group studies.

3.4.4 Exclusion criteria:

- Studies that reported an exercise intervention but not an engagement intervention or combined exercise with other behavioural interventions (for example, diet).
- Critical reviews, systematic reviews, comments, and editorial commentaries.
- Hospital-based rehabilitation interventions.
- Studies that were not reported in the English language (interpretation was not available).

3.4.4 Information sources

Specific database scope and content is highly variable, therefore multiple databases were searched (Rathbone et al., 2016). Searching occurred between October and November 2015 and incorporated PubMed, Medline, Psychinfo, EMBase, and AMED. English language article reference lists searching enabled identification of secondary studies. Attempts were made to contact authors of included studies where information was unclear or presented. The grey literature was not searched for practical reasons.

3.4.5 Search

The search strategy used the same search terms for all databases: health promotion OR behaviour change AND exercise OR rehabilitation AND intervention AND older* OR aged OR elderly. The term older was automatically exploded to retrieve citations that carry the specified Medical Subject Heading (MeSH) or subheading and also retrieve citations that carry any of the more specific MeSH headings (or sub-headings) indented beneath it in the tree structure. All other search terms were 'focussed'.

3.4.6 Data extraction

The primary reviewer (KA) undertook title, abstract, full-text eligibility screening, and two researchers (KA and KR) assessed full-text versions, PL

adjudicated where disagreement occurred. Endnote X7 facilitated data management.

A data capture form based on systematic data retrieval recommendations was used (Noyes and Lewin, 2011, The Cochrane Public Health Group, 2011) to record screening decisions (Appendix B). Information on the data capture form information included:

- Author and publication,
- Date and country,
- Study design and setting,
- Detailed methodology,
- Sampling,
- Analysis and reporting,
- Sample characteristics (sample size, age, and gender),
- Main intervention and outcomes,
- Engagement support strategy with the theoretical underpinning,
- Support strategy evaluation,
- Results,
- Study conclusions.

3.4.7 Study quality appraisal

Appraisal tools allow assessment of research findings based on quality, which is essential when interpreting their importance. In 2011, 182 critical

appraisal tools were available; this number is annually increasing (Higgins J, 2011). No consensual generic gold standard assessment tool exists (Katrak et al., 2004). A review of 44 critical appraisal tools demonstrated no reported validation process in 11, and 33 had not been reliability tested (Crowe and Sheppard, 2011). The reviewers, therefore, argued that many designed and published critical appraisal tools ignore the evidence available for design, comprehensive validation, and reliability testing. To mitigate the risk of flawed findings, two complementary appraisal tools were used in the present review. The literature recommends that any appraisals should also be narratively contextualised so that the reader has a greater understanding of the study background and any challenges (such as recruitment challenges) (Wuensch, 2015). As an example, dependent upon the numerical Effect Size (ES) (for example, ES 0.8), a limited narrative understanding of a 'small', 'medium', or 'large' effect, is offered by 'Cohen's d conventions' (Cohen, 1988). It is, therefore, difficult to choose one recognised valid, reliable, and easy to use quality assessment tool (Sanderson et al., 2007).

The selected quality measures were the Critical Appraisal Skills Programme (CASP) and Mixed Methods Appraisal Tool (MMAT) because the proposed literature search anticipated studies using quantitative, qualitative, and mixed methods. Both have strengths and weaknesses. CASP has specific methodological checklists (systematic review, qualitative, randomised controlled, case-control, diagnostic, cohort, economic evaluation, clinical

prediction), is logical, and intuitive. Recognised as being useful for highlighting and appraising study validity and contextual usefulness, CASP may, however, be less sensitive to qualitative validity (Chenail, 2008). Nevertheless, the tool enables the appraisal of several study types and has also been suggested to promote a proper methodical evaluation of qualitative research (Masood et al., 2011). Complementing CASP, and designed using an inductive constructivist perspective where multiple viewpoints are acknowledged (Creswell and Plano Clark, 2011), MMAT allows the simultaneous quality appraisal of qualitative, quantitative, and mixed methods studies (McGill, 2011). Six MMAT subsets guide each investigation for research question appropriateness, the relevance of data, components, quality, and description. MMAT criteria, overall quality score, and inter-rater agreement have been found to be moderate to perfect (Pluye et al., 2011, Pace et al., 2011). Both tools awarded scores of 2 where the answer to a given question was "yes" (for example, "Was the exposure accurately measured to minimise bias?"), 1 where the answer was "can't tell", and 0 where the answer was "no".

3.4.7 Outcomes

This review's primary outcome was effectiveness of strategies to support exercise engagement.

3.4.8 Data analysis

The included studies varied in design, primary outcome measured and intervention provided which precluded meta or sensitivity analysis. Therefore, a narrative analysis was appropriate because it highlighted similarities and differences (Ryan, 2013) and presented the data in a format that was useful for developing any future engagement interventions. A tabular form that reported study design and setting, sample characteristics, the primary exercise intervention, outcomes, the support strategy and its evaluated outcome was constructed.

3.5 Results

3.5.1 Study selection

Seven hundred and forty eight studies were identified (figure 7). Once duplicates were removed in the screening stage, titles and abstracts of the remaining 718 records were screened, and 691 studies were excluded, as they did not meet the eligibility criteria.

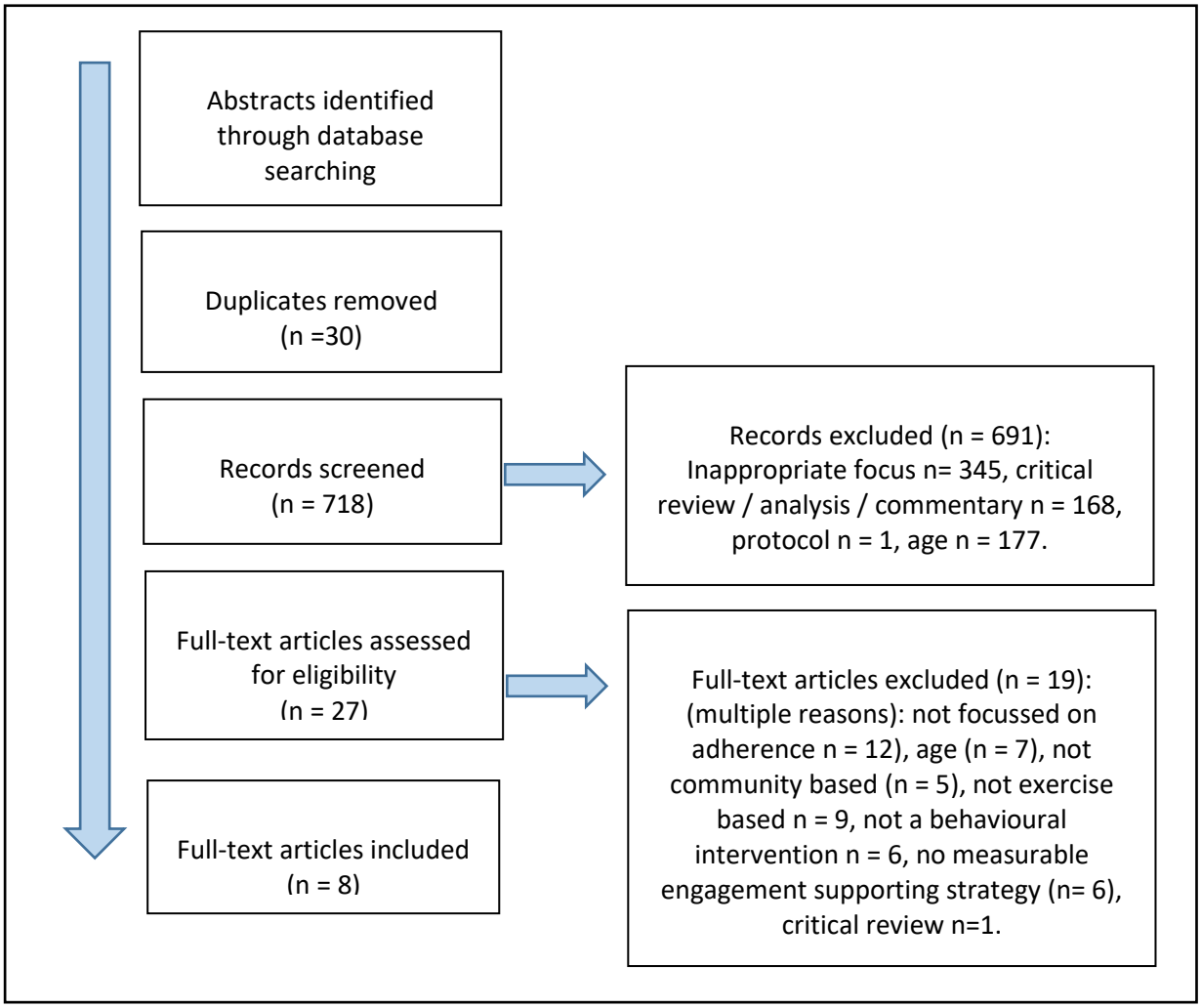


Figure 7: Flow of information

Appendix C provides a summary of excluded articles. For the remaining 27 articles, full-text versions were assessed, and 19 were deemed ineligible: 12 were clinically focussed and did not measure adherence, nine were not exercise based, five were not community based, six did not provide a exercise intervention, seven recruited mostly younger adults, six did not offer an intervention designed to improve and measure exercise engagement, and one was a critical review with no primary data. Some studies were considered ineligible based on more than one eligibility criterion. There were eight studies remaining included in this review.

3.5.2 Characteristics of individual studies

Table 7 details individual studies. The legend is below the table.

Table 7: Characteristics of incorporated studies

Author / publication year, country	Study design, setting, purpose	Sample characteristics (sample size, age, sex)	Main intervention	Main intervention findings	Engagement strategy with any theoretical underpinning	Engagement strategy evaluation	Engagement strategy outcome
(Gothe et al., 2015a); USA	Two-armed RCT; home set; compared generic healthy ageing DVD to DVD delivered exercise intervention designed to increase physical function.	N =307, mean age = 71.0 years. Median split created ≤70 years (mean 67.3 ± 1.7 years) and ≥71 years (mean 75.5 ± 3.9), 71.5% female.	Six months long, progressively challenging (complexity and physical demand) exercise programme (six exercise sessions contained two sets of 11–12 different exercises focusing on balance, strength, and flexibility. Participants provided with a yoga mat, two resistance bands and handbook).	Primary outcome: to promote physical activity levels Significant treatment effect for subjectively ($p = .004$) and objectively ($p = .05$) measured physical activity	Comprehensive engagement strategy including DVD, monthly personalised feedback with exercise tips, handbook (self-regulation, goal setting, removal of common barriers) Theoretical underpinnings: SCT	Comparison of comprehensive engagement strategy with healthy ageing DVD only	Combined strategy caused significant ($p < .05$) PA increase (46 min/week) in comparison to control group where control group MVPA declined (37 min/week).

Author / publication year, country	Study design, setting, purpose	Sample characteristics (sample size, age, sex)	Main intervention	Main intervention findings	Engagement strategy with any theoretical underpinning	Engagement strategy evaluation	Engagement strategy outcome
(Harada et al., 2010); USA	Feasibility study; home set; compared messaging intervention 'Health Buddy' (HB; the system used to monitor health status), to telephone monitoring to increase adherence to exercises	N = 38. Mean age 72.2 years, in-patients or outpatients mean age 78.0 (± 4.7) years, outpatient mean age 69.9 (± 7.9) years, 100% male.	Three months long. HB monitor beeped every 24 hours as a reminder for participants to perform general exercises. Control group sent a daily reminder text message to contact the help desk. HB system used exercise related branching logic (sequential questions with yes / no answers about exercise performance, walking, and adverse events). Same questions asked for control group, but had to contact the help desk first.	HB whole group exercise adherence rates higher than control (p = 0.007) HB group exercise adherence rate = 57.4% Telephone monitoring exercise adherence rate = 32.1%	'Health Buddy' system: support and knowledge of being monitored. No theoretical underpinning.	Adherence and participant satisfaction	HB adherence levels (57.5%) significantly (p ≤ .05) higher than control (32.1%) group. Satisfaction with HB score = 9.0 (± 2.8) (low score = high satisfaction; possible range: 7 – 35).

Author / publication year, country	Study design, setting, purpose	Sample characteristics (sample size, age, sex)	Main intervention	Main intervention findings	Engagement strategy with any theoretical underpinning	Engagement strategy evaluation	Engagement strategy outcome
(Iliffe et al., 2014, Gawler et al., 2016); UK (Gawler et al. (2016) provided additional detail; this paper was later sourced to complement the information from Iliffe et al., 2014)	Multi-cluster RCT comparing two SBE programmes; compared exercise groups versus home exercise programmes to increase exercise adherence	N = 1,256: group n = 387, home n = 411, usual care n = 458. Mean age 73 years (range 65 – 94), 84% aged between 65 and 79 years).62% female.	FaME: 9 months, once weekly, 1 hour, supervised session supplemented with twice weekly, 30-min sessions of a home exercise programme. Community centre based group exercise programme. Otago Exercise Programme (OEP): 6 months, Home based 30-min set of home exercises thrice weekly Usual care. Both SBE programmes largely equivalent in terms of content.	FaME 40% attended ≥75% of classes. OEP: 37% achieved ≥75% of home exercise prescription. 35% compliance without peer support, versus 39% compliance with peer support for achievement of ≥75% compliance.	FaME: weekly group support from instructor and peers. OEP: peer mentors for home exercises No theoretical underpinning	Exercise adherence rates ≥75%.	FaME: 40% attended ≥75% of classes. OEP: 37% reported ≥75% achievement of ≥75% of exercise prescription. Unclear reporting of analysis of MVPA levels in relation to adherence.

Author / publication year, country	Study design, setting, purpose	Sample characteristics (sample size, age, sex)	Main intervention	Main intervention findings	Engagement strategy with any theoretical underpinning	Engagement strategy evaluation	Engagement strategy outcome
(Kerse et al., 2005); New Zealand. More detail retrieved from: (Elley et al., 2003)	Post hoc subgroup analysis of cluster RCT; GP surgery and home set; compared 'Green Prescription' versus usual care to increase physical activity	N= 270 recruited from 42 primary care practices. Mean age 71.6 (±4.4) years, 68% female.	Three months long intervention, 12-month follow up. Exercise specific brief MI with follow-up contact/support (Green Prescription). Quarterly newsletters and written materials also despatched.	Significant change in leisure-time energy expenditure = 2.67 kcal/kg/week (95% CI 0.87–4.47; p = .004) compared to control group Change in leisure time MVPA 0.67 hours/week (95% CI 0.17–1.17; p = .008) compared to control group	Brief MI followed by personalised and ongoing support by exercise specialists over three month period (telephone, or group). Theoretical underpinnings: MI	12-month follow-up: leisure time energy expenditure and MVPA. SF36.	Over 12 months follow-up period, proportion of intervention group participants achieving MVPA goals rose by 17% compared to 6% in the control group (p = .06), For intervention group participants, vitality and general health scales of the 36-item Short Form showed statistically and clinically relevant improvements.

Author / publication year, country	Study design, setting, purpose	Sample characteristics (sample size, age, sex)	Main intervention	Main intervention findings	Engagement strategy with any theoretical underpinning	Engagement strategy evaluation	Engagement strategy outcome
(Murphy et al., 2008); USA	Multi-site RCT, set in 3 sheltered housing complexes and 1 day centre; compared exercise plus activity strategy training, versus exercise plus health education for arthritis symptom control and engagement in PA	N= 54; mean age 75.3 (± SD 7.1) years, 93% female	Six-months long; evaluated interventions ability to facilitate hip and / or knee osteoarthritis self- management, and therefore increase exercise engagement. Control = exercise + general health information.	No significant change in TUG (p = .85). Small (d = .03) and non- significant pain change (p = .47). Very small (d = 0) and non-significant (p = .56) arthritis self-efficacy change.	Engagement strategy: education how to pace activities, how to manage pain through joint protection and body mechanics. Peer support through group discussion. No theoretical underpinning	Comparison of 3-day home period with accelerometer for each group.	Short-term PA intensity increased in intervention group (p = .02) but total PA was not sustained (p = .08) because of unchanged self-efficacy for pain (p = .56). Attendance rates for Ex + AST (79%) and Ex + Ed (92%) sessions were high (significance not reported).

Author / publication year, country	Study design, setting, purpose	Sample characteristics (sample size, age, sex)	Main intervention	Main intervention findings	Engagement strategy with any theoretical underpinning	Engagement strategy evaluation	Engagement strategy outcome
(Notthoff and Carstensen, 2014b); USA	Randomised comparative study; home set; tested positive or negative framing of messages on walking duration	N = 127. Mean age 75.79 (SD 8.34) years, female 71%.	28 days long; Participants attended brief weekly information sessions (10-15 min) and were provided with either positive (walking benefits) or negative (risks of not walking) messages	People receiving positive messages, walked significantly more on average per day compared to those receiving negative messages (Mean steps (positive message) = 6,883.4, SE = 435.07, Mean steps (negative message) = 5,705.7, SE = 378.37, p = .04). Within-participant change showed that average daily walking significantly increased for those receiving positive	Message framing: positive, neutral, and negative. Theoretical underpinnings: Theory of Positivity.	Amount of walking as measured by a pedometer.	Statistically significant increased walking through positive messaging (p = .04 in comparison to negative messaging. Positive versus neutral messaging effects not reported.

Author / publication year, country	Study design, setting, purpose	Sample characteristics (sample size, age, sex)	Main intervention	Main intervention findings	Engagement strategy with any theoretical underpinning	Engagement strategy evaluation	Engagement strategy outcome
				messages but not nor those receiving negative messages.			
(Resnick et al., 2008); USA	RCT; sheltered housing set, compared combined exercise and motivation ('exercise plus') versus exercise only ('exercise only' to motivation only ('plus only') sessions to increase adherence to home-based	N= 157; mean age 81.0 years (SD 6.9). 100% female.	12 months long. Supported by twice-weekly home visits which changed to weekly telephone calls. During the final four months of the study. Maximum total number of visits was 38. Control arms = exercise only and support only.	No significant treatment effect Primary outcome: 12-month adherence as measured by mean sessions attended across post hip fracture recovery trajectory.	Motivational component: education, verbal encouragement, goal setting, positive reinforcement, removal of unpleasant sensations associated with exercise and individualised cueing.	Intensity and frequency of exercise participation over 12-month intervention period.	Non-significant difference (p = 0.11) between adherence rates of the different treatment arms: Ex Only = 26.9 mean sessions Plus only = 28.99 mean sessions

Author / publication year, country	Study design, setting, purpose	Sample characteristics (sample size, age, sex)	Main intervention	Main intervention findings	Engagement strategy with any theoretical underpinning	Engagement strategy evaluation	Engagement strategy outcome
	exercise interventions.				Theoretical underpinnings: SCT and self-efficacy theories.		Exercise Plus = 27.55 mean sessions
(Schneider et al., 2004); USA	Pilot RCT; YMCA centre or home set; explored effect of CBT on physical outcomes and exercise engagement. .	N= 16. Mean age 76.3 (± 5.7) years, age range 67.0 to 86.0 years, 62% female.	Two months long. Progressive flexibility, strength, and endurance exercise programme. The experimental group received additional CBT. But not the control group. All participants initially attended group exercise training 3 times per week	Age-adjusted physical indicator improvements. Large upper body strength (ES .62). Medium lower body strength (ES .43). Medium functional score (ES .40). Large hamstring flexibility (ES .63). Small 6-	Engagement support strategy: CBT for 6 sessions of 50 minutes. Theoretical underpinnings: Cognitive Behavioural Therapy	Assessment of exercise adherence during leisure time as measured by self-reported GLTEQ.	GLTEQ demonstrated improved overall exercise behaviour but only small effect size (ES .12) (significance not reported)

Author / publication year, country	Study design, setting, purpose	Sample characteristics (sample size, age, sex)	Main intervention	Main intervention findings	Engagement strategy with any theoretical underpinning	Engagement strategy evaluation	Engagement strategy outcome
			for 2 weeks, then once per week for 6 weeks. During this period, participants were also encouraged to exercise at home at least twice per week.	minute walk test (ES .24).			

Table Legend: AST: Activity Strategy Training; BP: Blood Pressure; CBT: Cognitive Behavioural Therapy; CEDS: Centre for Epidemiological Studies Depression Scale; CHAMPS: Community Healthy Activities Model Program for Seniors; CI: Confidence Interval; DVD: Digital Video Disk; ES: Effect Size; FaME; Falls Management Exercise; GLTEQ: Godin Leisure Time Exercise Questionnaire; IPAQ: International Physical Activity Questionnaire; MVPA: Moderate to Vigorous Physical Activity; MI: Motivational Interviewing; SF36: MOS Short Form Health Survey 36; OEES: Outcome Expectations for Exercise Scale; OEP: Otago Exercise Programme; PA: Physical Activity; RCT: Randomised Controlled Trial; SBE: Strength and Balance Exercises; SCT: Social Cognitive Theory; SESE: Self –Efficacy for Exercise Scale.

The oldest published study was in 2004 (Schneider et al., 2004), and the most recent in 2015 (Gothe et al. 2015). Six studies originated in the USA; the remainder originated in New Zealand and the UK. Study types included Randomised Controlled Trials (n = 4), a pilot Randomised Controlled Trial (n = 1), a post hoc analysis of a Randomised Controlled Trial (n = 1), a comparative study that did not include a control arm (n = 1), and a feasibility study (n = 1). Study sizes ranged from 16 to 1,256 participants. Mean study size was 248 participants (SD 369.3), with a mean weighted age (accounting for study size) of 73.5 years (Weighted SD 8.6 years). Six studies recruited mixed gender participants; of these, 71% were female. Two studies recruited single-sex participants (Harada, 2010 and Resnick, 2008). Four studies were based in the participants home (Gothe, 2015, Harada, 2010, Kerse, 2005, and Notthoff, 2014), two within groups (Iliffe, 2014, and Schneider 2004), and two within sheltered housing complexes (Murphy, 2008, and Resnick, 2008).

The average engagement intervention lasted five months with a range of 28 days and one year. The main identified successful engagement strategies were comprehensive support packages (Gothe, 2015, Harada, 2010, Kerse, 2005, Murphy, 2008 and Resnick, 2008), message framing (Notthoff, 2014) and social support (Gothe, 2015, Harada, 2010, Iliffe, 2014, Kerse, 2005, Murphy, 2008 and Resnick, 2008). The next sections describe these in detail.

3.5.3 Study quality appraisal

Table 8 presents the quality appraisal results, which demonstrated an overall quality appraisal mean percentage per article for the combined CASP and MMAT scored of at least 67.5%, five studies attained a mean of 80% or more of the total available score.

Table 8: Quality appraisal

Lead author	CASP score	CASP %	MMAT score	MMAT %	Mean %
Gothe	16/22	73%	11/12	92%	82.5%
Harada	14/22	64%	11/12	92%	78%
Kerse	18/22	82%	9/12	75%	78.5%
Iliffe	18/22	82%	8/12	67%	74.5%
Murphy	17/22	77%	10/12	83%	80%
Notthoff	20/22	91%	10/12	83%	87%
Resnick	19/22	86%	10/12	83%	84.5%
Schneider	15/22	68%	8/12	67%	67.5%

Available information, which was occasionally limited, formed the quality assessment decisions. For example, Resnick and colleagues (Resnick et al., 2008) failed to report how many participants were in each group and scored poorly in this area (Knittle, 2014). Equally, although no specific reference to an underpinning theory was made within the sourced report for the review (Iliffe et al., 2014), the author acknowledged that the SBE

instructors were trained in a number of support strategies such as programme tailoring and following up non-attendees.

Two reasons accounted for Schneider and colleague's moderate score (Schneider et al., 2004). Firstly, researchers delivered Cognitive Behavioural Therapy (CBT) before or after exercise sessions at the participant's preference, which may have biased the results. Secondly, participants self-administered the Borg Rating of Perceived Exertion scale (RPE). Such self-administration has been shown to reduce the test-retest reliability of the RPE scale when used to monitor subjective estimates of exercise intensity (Lamb et al., 1999).

The possibility of self-selection bias could not be excluded in three studies (Murphy et al., 2008, Resnick et al., 2008, Schneider et al., 2004) because potential participants were recruited from a pool of those already interested in taking part in a research study. Potentially caused by ethical constraints or individual characteristics (Hewison and Haines, 2006), such bias might result in inappropriate randomisation and therefore variable responses to research questions. In turn, this diminishes the ability to infer causation ('this study demonstrated that x intervention caused y effect') and therefore the generalizability of the findings. Such phenomenon might remain unapparent because statistical measures of confidence of the parameter's precision (usually 95%) are not designed to detect sampling bias (Shadish et al., 2001, Sim and Wright, 2002).

Gothe and colleagues (2015) recruited mainly white (97%) participants who held degree (90%) level qualifications, which reduced the generalizability of their findings to the broader population. Equally, Murphy (2008), Schneider (2004), Harada (2010), Resnick (2008) and colleagues all recruited mainly white, highly educated participants. Notthoff and colleagues (2014) recruited mostly European American (90%) participants, 2% were African-American, 5% were Asian American, and 3% reported other/mixed or no ethnicity. Iliffe and colleagues (2014) reported that 14% of participants were non-white, with greater ethnic diversity among the London participants. Kerse (2005) and colleagues did not report participant ethnicity and education backgrounds.

3.5.4 Synthesis of results

This next section synthesises the results into different strategy types.

3.5.4.1 Comprehensive support packages

Five studies used comprehensive support packages to help participants engage with the main exercise intervention.

In their analysis, Gothe and colleagues (2014) demonstrated a median split where as expected, older participants (mean age 75 years) were less

physically active at baseline as compared to their younger counterparts (mean age 67 years). Their six-month-long study showed that a comprehensive package of DVD with detailed instructions, tailored exercise, completion of activity logs, personalised feedback and support calls with exercise tips could result in higher levels of MVPA than a professionally developed generic healthy ageing DVD. Notably, accelerometry data showed a significant treatment and age group effect, and the older participants demonstrated moderate to substantial health benefits at follow up.

In their evaluation of an occupational therapist–led intervention to promote symptom control and physical activity, Murphy and colleagues (2008) recruited older people with hip or knee osteoarthritis to either exercise with activity strategy training or exercise with health education. The insufficiently powered study could not detect statistically significant changes, but in comparison to the education group, the provision of group-based activities, which helped participants to deal with challenges to engaging in an exercise programme, yielded significantly higher levels of vigorous physical activity. Nonetheless, unchanged pain self-efficacy meant that such physical activity levels were not sustained.

In their 12-month long study, Resnick and colleagues (2008) recruited older people who were living in sheltered housing and had sustained a surgically repaired non-pathologic fractured hip. The researchers compared exercise only sessions, motivation only sessions or a combination of both exercise

and motivation interventions. In the motivational component, twice-weekly home visits initially supported participants until the final four months; then this reduced to weekly visits and telephone calls. Exercise only participants were taught unsupervised resistance, stretching and aerobic exercises. The motivational component included self-efficacy-based interventions using education, verbal encouragement through goal setting and positive reinforcement, removal of unpleasant sensations associated with exercise and individualised cueing. Assuming that participants completed all rehabilitation services by one-month post-fracture, the maximum number of anticipated intervention sessions was 38. In the early recovery stages, those with stronger self-efficacy were more likely to participate in the training. During the two to six month periods, these self-efficacy expectations positively influenced outcome expectations. Outcome expectations, depressive symptoms, and social support from experts directly affected adherence to sessions. During the six to twelve-month post hip-fracture period, those who had lower physical health status, less pain, and stronger self-efficacy expectations were more likely to adhere to visits. Although reporting an overall adherence rate of 50%, this varied throughout the study duration. These study findings demonstrate that engaging older people in exercise is challenging.

Schneider and colleagues (2004) reported a pilot study that examined the effects of a cognitive behavioural therapy intervention on exercise behaviour and physical outcomes in 16 healthy, sedentary older people. All

participants were taught progressive flexibility, strength, and endurance exercises. The control group received no additional treatment. The intervention group members were trained to recognise negative exercise related thoughts and to counter these with ones that are more positive. After adjusting for age, the intervention had a medium to large effect on improving participants' 6-minute walking distance, standing full tandem, hamstring flexibility, upper body strength, lower body strength, and functional score. These measures increased by 3.8% to 22.9%. After adjusting for baseline exercise behaviours, the intervention group showed 7.5% greater overall exercise behaviour than the control group. Data showed a moderate improvement in improving self-reported exercise behaviour and a mild effectiveness in improving general exercise behaviour.

Together, these findings suggested that different factors influenced engagement. For example some older people interpreted exercise differently according to their ability to control physical conditions such as pain. The researchers asserted that exercise adherence could improve where providers improve personal physical challenges (such as pain), social isolation, environmental problems, self-efficacy levels, and the expected outcome of exercise.

3.5.4.2 Message framing

Two studies investigated messaging as an engagement support strategy. Notthoff and Carstensen (2014) used positive versus negative messaging, and Harada et al. (2010) examined the Health Buddy system.

Notthoff and Carstensen (2014) used positive, versus negative messaging in their study with 66 older participants (mean age 76 years). In a series of four weekly sessions that lasted approximately 15 minutes, participants were informed either about the positive features of walking, or the negative consequences of failing to walk. The study indicated a possible correlation between receiving a positive message and walking (number of steps). This suggested that positive messages could potentially reduce inactivity levels in sedentary healthy older people. The effectiveness of positively framed messages versus neutral framing or neutral versus negative framing was, however, unclear.

Sedentary older people received the Health Buddy system's reassurance that they could safely exercise despite their ongoing health conditions in Harada and colleagues' study (2010). The system emitted a soft beeping sound every 24 hours. In the telephone-monitoring group, participants called the researcher on a daily basis. A series of branching logic questions, interspersed with motivational and educational messages, explored exercise-related factors (exercise performance, walking, and adverse events). In the Health Buddy group, questions were similar, as were the

educational and motivational messages. A researcher reviewed the daily data and then contacted the participant by telephone in the event of reported adverse reactions such as chest pain, dizziness, or falling. At eight weeks, intervention adherence rates were significantly higher than in the control arm (57.4% versus 32.1%, p = 0.007). Health Buddy adherence declined after 11 weeks but this was three weeks after a drop in the text-messaging arm, and the researchers proposed that this resulted from participants changing goals and boredom with the intervention itself.

Together, these findings suggested that positive messaging supports exercise engagement, but that interventions need to accommodate and adjust to peoples changing goals.

3.5.4.3 Social support

Two studies reported that social support could potentially increase motivation to carry on with exercise. Iliffe and colleagues (2014) recruited 43 general practices, who then facilitated recruitment of 1,256 medically stable, independently mobile older people; 22% of whom had one to two falls in the previous year. The researchers randomised participants into two groups and offered two different exercise programmes. In the Otago Exercise Programme (OEP) group, participants completed thrice weekly progressively challenging, lower limb strength and balance exercise training for up to 30 minutes alongside a walking plan (moderate pace, at least

twice per week, for 24 weeks). On five occasions (if available), trained peer mentors visited participants at home and offered up to 12 telephone contacts. In the FaME group, participants completed a 1-hour-long instructor delivered group exercise class in a local community centre and two 30-minute home exercise sessions per week for 24 weeks. Of FaME participants, 40% attended ≥ 75% of programmes in comparison to 37% of OEP participants who reported that they achieved ≥ 75% of the home exercise prescription. Equally, the strategy of ongoing support within the FaME arm meant that the proportions who engaged with optimal levels of exercise increased (from 40% to 49%) more than the OEP arm (from 41% to 43%), and the usual-care arm (from 37.5% to 38.0%).

Kerse and colleagues (2005) recruited 278 sedentary older people. Primary care doctors or practice nurses delivered brief motivational interviewing and then formed a "Green Prescription" which involved the discussion of increasing physical activity with a decision of appropriate goals. Primary care practitioners initially delivered a brief intervention of Motivational Interviewing (MI) and then, over a further three month follow up period, trained exercise specialists supported this. Of surveyed users (Ministry of Health, 2016), 81% felt that such extended support improved their long-term motivation to exercise autonomously (Kerse et al., 2005). Exercise specialists later provided at least three telephone calls (lasting 10-20 minutes) over the next three months to encourage and support them. When applicable, the exercise professionals used motivational interviewing

techniques to increase physical activity and signposted to exercise or community groups. Additionally, participants also received quarterly newsletters about physical activity initiatives in the community and motivational materials. General Practice staff members were encouraged to provide feedback to the participant on subsequent practice visits. Control group participants received the intervention at the end of the study. The one-year follow-up rate was 85% and, although failing to reach statistical significance ($p = .06$) over the 12 months follow-up period, the proportion of intervention group participants achieving recommended physical activity levels rose by 17% compared to 6% in the control group. Significantly, intervention participants self-rated "general health," "role physical," "vitality," and "bodily pain" all improved.

These findings suggested that offering membership of a supportive group (Iliffe, 2014) and motivational interviewing (Kerse, 2005) can improve the motivation to engage in physical activity.

3.5.4.4 Theoretical underpinnings

Three studies lacked a theoretical underpinning (Harada, 2010, Iliffe, 2014, and Murphy, 2008). The 'Theory of Positivity' underpinned one study (Notthoff, 2014), the SCT underpinned two studies (Gothe, 2015 and Resnick, 2008), the theory behind Motivational Interviewing underpinned

one study (Kerse, 2005), and Cognitive Behavioural Therapy underpinned one study (Schneider, 2004).

3.6 Discussion

This systematic review identified eight articles that evaluated studies aiming to encourage older people to continue with physical exercise classes in their community with the use of various exercise engagement strategies. The findings suggested that positive messages (verbal or textual), social support or a comprehensive support package might be helpful in promoting exercise engagement. Some studies included a single definable engagement support strategy; some included a combination of several support strategies based on a behaviour change theory.

3.6.1 Engagement strategies using one component

Positive messages improved older peoples' motivation to walk (Notthoff and Cartensen, 2014). This reflects the results of a recent RCT which included older adults from a European upper-middle-income country, and showed that text messages significantly increased exercise behaviour (Müller et al., 2016). An interview analysis embedded in this study indicated that participants experienced the messages as encouraging and used them as reminders to complete the exercises. A literature review involving community dwelling older people (Ostrander et al., 2014) also indicated

that text messages could increase physical activity, though, their effectiveness improves when they are specific to the environment of the participants (e.g. include local walking routes), take account of the participant's stage of behaviour change and include an activity partner. The supporting effect of positive in contrast to negative messages might be due to older people remembering and attending to more positive than negative information (Reed and Carstensen, 2012, Kensinger et al., 2007). The results of this review confirm that exercise providers who aim to improve exercise engagement should ensure the provision of positive messages as opposed to negative messages in verbal and written literature.

3.6.2 Engagement strategies using several components

Combined engagement support strategies including more than one support component can significantly improve adherence to exercise programmes. The findings of this review indicated that research teams combined engagement strategies with exercise packages (Gothe et al., 2015a, Iliffe et al., 2014), and aimed to support people to take responsibility for completing their personalised programme. In these studies, the exercise trainer adapted their approach for each participant. Both studies indicated that being a member of a group with continued support maintained the capability to perform exercises. The idea of providing several different techniques to encourage older people to exercise is backed up by other

studies. Zubala, for example, indicated in his systematic review of physical activity promotion interventions that, in comparison to multi-faceted motivators, the use of one strategy alone might be less suitable for older people (Zubala et al., 2017). Some combined strategies appear to be relatively easy to implement, for example, choosing flexible goals that are personally meaningful, as they rely on adapting the existing exercise programme. They are, though, often difficult to unravel from the primary exercise intervention, for example providing telephone calls to participants could be seen as a way of booking the next exercise class or as a method of encouraging a person to attend the next class. Research evidence from dentistry and education however, supports the approach of empowering participants in their autonomous adherence to relevant behaviours (Halvari et al., 2013, Taylor et al., 2014).

The Green Prescription (Kerse et al., 2005, Ministry of Health, 2016) was another multi-faceted engagement strategy and included MI and personal support by phone or in a group to increase exercise engagement. Increasing the duration and intensity of support to nine months enhanced the intervention and was found to be cost-effective (Elley et al., 2011). Importantly, their ongoing support for autonomous physical activity performance also involved signposting to various activities that encompassed the social component of exercise engagement, such as walking and swimming groups, or gym classes.

This finding reflects earlier research, which suggested that the Green Prescription improves long-term recreational physical activity (Swinburn et al., 1998). Compared to brief verbal assessment and advice alone, a review of 48 studies (Lundahl et al., 2013a) further supported these findings by demonstrating a small but significant effect in the improvement of health-related behaviours by the provision of MI. Several investigations have explored the delivery of MI for older peoples' community set programmes. By adding MI to SBE though, adherence to the exercises was demonstrated to improve within a series of four studies involving 175 community dwelling older people living in the community (Arkkukangas, 2017); this result remained so at the 52-week follow-up. A systematic review of health behaviour change in primary care included eight relevant studies, three of which focussed on physical activity alone (Purath et al., 2014). The authors' findings supported the concept that MI may be effective when incorporated into health promotion and preventative interventions. However, they asserted a note of caution when interpreting the results because of differing accuracy descriptions. When combined with an exercise programme, MI has also been shown to be effective for improving physical mobility, psychological well-being and self-efficacy while decreasing chronic pain levels (Tse et al., 2013). Of note, exercise adherence has been demonstrated to improve with physiotherapeutic behavioural medicine, especially in those living with chronic pain and low self-efficacy levels, but they are not automatically included in traditional physiotherapy (Cederbom et al., 2014, McGrane et al., 2015).

In the improvement of exercise engagement, the Green Prescription (Kerse et al., 2005) incorporated appropriate signposting, which suggested that it might be beneficial for OPREE. Recent policies indicate that the UK Local Government Association is increasingly encouraging the adoption of a similar model to the 'Green Prescription' which also encourages signposting to social outdoor physical activities (Eichler, 2016).

As well as studying what went well, this review found several barriers to successful exercise engagement strategies. Difficulty in recruiting peer mentors (Iliffe et al., 2014) potentially led to poor compliance or exercise progression (Gawler et al., 2016), and therefore group exercises alongside positive messages from the trainer might be more feasible. Inflexible interventions also risk reduced long-term efficacy (Resnick et al., 2008), and therefore they need to remain relevant, appropriate and interesting (Harada et al., 2010).

3.6.3 Engagement strategies that utilise philosophical theories

As well as the practicalities, the review showed that Gothe, Kerse, Notthoff, Resnick, and Schneider and colleagues all used a theoretical underpinning which aligns with renowned researchers recommendations (Michie et al., 2014). While MI is not a theory, it has similarities with the Self Determination Theory where both promote the ability to manage general health problems (including exercise behaviour) autonomously and adapt to changing needs, goals, and desired support networks. Together, these

findings further reinforced that interventions should be appropriate to the person and have the ability to support the participant's needs. Also, in the improvement of exercise class attendance, the achievement of personally significant goals was demonstrated to be significantly associated with a change in physical activity levels (Oliver et al., 2016).

3.7 Strengths and limitations

This review's strengths were that the research followed respected published guidance (Shenkin et al., 2017), and rigorously employed a published protocol, predefined search terms and data collection forms (Appendix A), and two critical appraisal tools (CASP and MMAT). The appraisal tools highlighted that all included studies were at least of moderate quality; most were of good quality. Few studies were eligible to be included because numerous excluded studies focussed on younger adults or did not present results of utilised engagement strategies (Appendix C).

This systematic review intentionally focussed on exercise rather than physical activity because there are additional health benefits to exercise compared to physical activity, but in hindsight, the extra term 'physical activity' might have yielded more results. For example, a meta-analysis evaluated the long-term effectiveness of interventions to promote physical activity, and identified 17,859 publications but only included 32 studies of

21 individual trials (Hobbs et al., 2013). However, supporting this review's search strategy, the eligible papers included a wide range of interventions using different exercise engagement strategies.

One included strategy that increased older peoples' walking was the theory of positive messaging (Notthoff and Carstensen, 2014a), but participants in their study were healthy. Thus, the results might not apply to those older people living with health limitations such as arthritis because exercise can cause short-term pain, which could potentially reduce the positivity effect (Reed and Carstensen, 2012). Equally, such positive messages might not account for factors such as a fear of falling. An included study (Murphy et al., 2008) compared two separate, but simple engagement strategies to improve physical activity engagement. They found that health education alone was ineffective in the improvement of physical activity levels, but by teaching adaptive methods of performing activities, short-term exercise engagement increased.

Only peer reviewed articles in the English language were included as a form of quality assurance and identified level of importance. While no articles written in other languages were identified in the early stages of the review, many systematic reviews apply these restrictions rigidly with the potential consequence of restricting the flexibility necessary when tailoring an intervention. Such a restriction also risks reporting bias; a phenomenon seen when journals only publish studies with positive results. However, during the initial phases of the review, no such studies were identified or

excluded. Another potential limitation of this review was that only one reviewer identified the studies for potential inclusion. This occurred because no funding allowed for additional reviewers. To mitigate this feature, two independent reviewers screened the full articles before inclusion. Finally, this review's findings are summative rather than analytical (Sim and Wright, 2002); it is therefore not possible to state the effectiveness of one particular strategy. This review does highlight the scarcity in literature on exercise engagement approaches which may be a significant research gap to address.

3.8 Conclusions

Although this systematic review identified several potential exercise engagement strategies, it was unable to locate one individual intervention that definitively improved older peoples' exercise engagement. The review suggested the effectiveness of an approach that combined positive messaging with the Green Prescription, which included Motivational Interviewing and signposting. Such an approach would need to be appropriate to the context and person while being sustainable over an extended period. Thus, interventions would include positive messaging, regular monitoring and feedback, motivational interviewing, and signposting people to appropriate services.

Chapter four explores what an exercise engagement intervention might look like from the perspectives of older people and NHS staff members.

Chapter Four: Interviews and a focus group

4.1 Summary

This Chapter builds upon the systematic review findings presented in Chapter three. Twelve patient interviews aimed to understand the contextual nature of exercise engagement and the types of acceptable and potentially useful services. Two healthcare professional interviews and a focus group with six members of staff explored the acceptability of proposed components of a potential strategy for increasing patient engagement in rehabilitation programmes and their perspectives of factors that influence the patient's ability to engage in exercise. Interview data were analysed using Framework Analysis. The findings suggested that older people engage in exercise with the purpose of maintaining physical, psychological, and social independence despite various health conditions. Interview findings supported the acceptability of continued personalised feedback, home visits, and appropriate signposting. The Chapter concluded with a summary of the conclusions and recommendations. Chapter five then synthesises findings regarding the development of an intervention (OPREE) to promote patient adherence to the Strength and Balance Exercise (SBE) programme.

4.2 Introduction

The most significant aim of rehabilitation is the retrieval of post-injury function or reduction of impairment resulting from an underlying medical condition. Adherence to exercise programmes is therefore crucial but often suboptimal (DeMaria, 2012) but, the reasons are frequently unclear. Preceding discussions within this thesis informed this qualitative study and sought to investigate these interactions.

The concept of habit through social norms, disease severity, perceived barriers or self-efficacy, or personal vulnerability to a loss of independence has been the focus of much research. The most prominent approaches are the SCT (Bandura, 1986), Protection Motivation Theory (Maddux and Rogers, 1983), Theory of Reasoned Action (Fishbein and Ajzen, 1975) and the Health Belief Model (Rosenstock et al., 1988), the Theory of Planned Behaviour (TPB) (Ajzen, 1991). Jointly, the theories hold that attitudes, situational cues (such as friendship circles), experienced normative pressure, and perceived locus of control (internal or external) drive the intention to either adhere to exercise or not (Verplanken and Melkevik, 2008, Hagger and Chatzisarantis, 2005). In particular, the TPB holds that a positive or negative attitude to exercise is formed over an extended period and intertwines with subjective norms and perceived behavioural control (de Bruijn and Rhodes, 2011).

However, later adherence to a rehabilitative exercise programme is not necessarily predicted by previous positive encounters with physical exercise

(Carlston, 2014, Schwarzer et al., 2008). Consequently, the particular type of activity, personal preferences, and physical and social limitations all influence adherence. Hence, it is necessary to understand the basis of older people's exercise habits and the underlying reason (Verplanken and Melkevik, 2008). The literature also emphasises that exercise adherence cannot be improved by providing health information (Lequerica and Kortte, 2010) or identifying causative factors (Sniehotta et al., 2014). Conversely, research emphasises the need for culturally appropriate (French et al., 2012), theoretically sound, replicable (Michie, 2013) behaviour change techniques that involve and empower (Lequerica and Kortte, 2010) older people. As an example, researchers identified that social cognitive variables were more indicative of long term exercise adherence than the prevention of future events or injuries (Schwarzer et al., 2008).

The suggestion, therefore, was that OPREE needed to investigate socio-emotive underpinning values and attitudes to exercise (Verplanken and Melkevik, 2008). Chapter two also detailed Self-Determination Theory (SDT) (Deci and Ryan, 2002b) as this thesis' theoretical underpinning. Briefly, SDT proposed that a person might not adhere because they do not see the value (*amotivation*). A person might adhere because they feel obliged to do so (*introjection*). The reduction of joint pain might form an *identified* motivational factor, but an 'integrated regulation' might be evident in a person who adheres for external reasons and is yet to 'buy into' the values and beliefs of exercise. Where pleasure or curiosity forms the primary motivation (*intrinsic*), long-term exercise class attendance is more

likely. The theory also enabled an understanding of the interplay between those inherently human extrinsic forces (such as social isolation) and the intrinsic motives and needs (such as regaining functional levels) (Deci and Ryan, 2002b, Ntoumanis et al., 2018, Hancox et al., 2017). Although Chapter three's systematic literature review revealed strategies that target regular personalised monitoring and supportive feedback are promising, research also highlights that the promotion of adherence to healthy behaviours is complicated.

Findings from the scoping review (Chapter two) and the systematic review (Chapter three) informed the design of this qualitative study. The *a priori* lines of inquiry were to investigate those variables that influenced respondents' adherence to the exercise classes, and to inform an intervention to increase attendance.

4.3 Aim

To explore the factors that influence older peoples' exercise engagement and to explore the acceptability of a strategy for increasing engagement with rehabilitative exercise regimes.

4.4 Research questions

This qualitative interview study focused on two broad questions:

1. What underlying influences and reasons affect older peoples' full, or partial adherence or abandonment of exercise activities?
2. What do older people and health professionals consider to be the relevant, acceptable and useful interventions that can promote engagement with the strength and balance exercise programme?

4.5 Methodology

Complicated personal, social, and cultural interactions influence (King and Horrocks, 2010) how and why older people either engage or disengage with exercise (Moore et al., 2011b). This qualitative study utilised in-depth semi-structured interviews and a focus group because they enabled the exploration of these intertwining factors (Brennan, 2016).

4.5.1 Choosing a qualitative method

The umbrella term of qualitative research captures a breadth of methodologies (Drench et al., 2007) that enable the understanding and description of the subjective human experience. In broad terms, quantitative research adopts a deductive positivist stance, and qualitative research an inductive interpretive stance. Ontologically (the beliefs about reality), positivists pride themselves on objectivity and the ability to distinguish between fact and value judgements (Sweeney & Griffiths, 2002). Understandings arise by disassembling items, studying them in

depth and statistically and mathematically reassembling them in a non-contextualised cause and effect setting that enables generalisations of findings to different populations (Shadish et al., 2001). Thus, positivists' beliefs lead to an etic epistemology (the relationship between the researcher and what can be known) where truth can be measured objectively from a distance. As an example, a quantitative investigation might identify a significant difference between exercise group referral and uptake rates (Crone et al., 2009), but not the contextually complicated reasons for that difference (Kroll and Morris, 2009). The scoping review in Chapter two emphasised the need to understand the diverse, poorly understood (Sim and Wright, 2002) and often hidden reasons for exercise engagement or disengagement that dispassionate and objective observation might not be able to capture (Flick, 2014). The acceptability of potential interventions also needed to be understood, therefore a positivistic form of inquiry was inappropriate.

Qualitative methods can discover the depth and complexity of influential perceptions (Freeman, 2008) that affect interventional research. Qualitative research is not intended to achieve generalisability because the qualitative paradigm aims to better understand respondent's views of the social world through the meanings and detailed stories of their actions (Myers, 2000). Given the nature of qualitative studies, they tend to form inductive arguments that cannot be generalised to the broader population, but that is not their value or purpose. Typically, inductive analysis works

from the bottom up to construct explanation and theory versus the hypothetico-deductive method of positivist research. Thus, qualitative research has been defined as follows:

> *"Qualitative research is an inquiry process of understanding based on distinct and methodological traditions of inquiry that explore a social or a human problem. The researcher builds a complex, holistic picture, analyses words, reports detailed views of informants and conducts the study in a natural setting"*
>
> (Creswell, 1998) (p. 15).

While some commentators suggest that qualitative research offers a 'soft approach' with a subjective focus and weak explanations for findings, rigorous methodological qualities offset such criticisms (Myers, 2000). One previous criticism was that qualitative studies tend to use relatively small samples, but this forms a strength because purposefully chosen small samples generate rich knowledge from detailed data. Similarly, qualitative researchers embrace the concept that it is the skill and insight of the researcher which determines the quality of the analysis and its value (Pope et al., 2000, Jeanfreau and Jack, 2010). The thoroughness of the study itself, therefore, enables the reader to judge the contextualised interpretations of data (Jeanfreau and Jack, 2010). Comparison and contrast facilitate the identification and analysis of key themes or recurring patterns in the data. Such analysis allows each respondent's views to

remain connected to other aspects of their account without loss of the contextuality of individual opinions (Gale et al., 2013).

Two methods of qualitative data collection were utilised: face to face interviews and a focus group. In-depth interviews mostly occur in naturalistic settings that facilitate the identification of non-generalisable (King and Horrocks, 2010) issues that are most significant to respondents (Sofaer, 2002). Therefore, with cues such as voice, intonation, or body language that supplement the immediate and spontaneous verbal answer (Opdenakker, 2006), such discussions captured individual perspectives, values, attitudes and beliefs (Ziebland and McPherson, 2006).

Notably, the study inclusion criteria necessitated a referral to a community set exercise programme for a problem that predominately affects older people. Thus, given the a priori research questions and a *neatly packaged* homogenous sample, Framework Analysis appeared to be a suitable analytic framework (Creswell and Plano-Clark, 2011).

4.5.2 Framework Analysis

Framework Analysis (FA) provides a flexible and practical method of managing data (Spencer, 2017, personal communication) that is inherently compatible with applied health services interpretive studies (Srivastava and Thomson, 2009). It is not however, an 'easy' version of qualitative research

for quantitative researchers (Braun and Clarke, 2006, Normansell et al., 2016). An audit trail also assures that the findings were systematically transparent, comparative, dependable, and confirmable (Gale et al., 2013, Srivastava and Thomson, 2009).

FA starts with some a priori codes to which relevant text can be allocated deriving from questions and topics, but allows flexibility and scope for the researcher to extend the analysis to include the recognition of new and potentially unanticipated additional themes (Parkinson et al., 2016). The homogenous sample in this study also highlighted that the method was suitable (Gale et al., 2013):

- Adults predominately over the age of 65 years, community-dwelling and independently mobile with an endangered level of independence because of at least one fall in the preceding year.

In the case of this thesis, the scoping and systematic reviews presented in Chapters two and three informed the subject of interest. Thus, because the approach draws explanatory themed conclusions through the identification of commonalities and differences between different parts of the data (Gale et al., 2013), FA was judged appropriate for this qualitative study.

4.5.3 Defining a Sample

This study used a sample of older people who were referred for SBE training due to a fall or continued risk of falling. While there is no consensus among

qualitative researchers about optimal sample sizes (Spencer, 2017, personal communication), qualitative sampling does not claim to be representative of populations (Guest et al., 2006). Instead, the appropriate sample size depends (Baker and Edwards, 2012) on the study scope, methodological approach, sample demographic makeup (Guest et al., 2006, Beitin, 2012, Bonde, 2013) and the available time and resources. Given that this study aimed to build a detailed and holistic picture of informants views in a natural setting (Creswell, 1998), a small sample size was justifiable to understand the underlying influences and reasons affecting older peoples' full, or partial adherence or abandonment of exercise activities.

4.6 Methods

This next section describes the methods employed in this qualitative study.

4.6.1 Study design

Interview and focus group questions were intended to understand the reasons for older peoples' full or partial adherence, partially adhere to, or abandon exercise performance. They also investigated the relevance, acceptability and usefulness of interventions that the scoping and systematic reviews identified in the promotion of engagement with the SBE programme.

4.6.2 Research ethics

University of Nottingham sponsorship, ethics committee, and research and development department approvals were sought and gained before any approach was made to potential respondents (Appendix D). Full details can be found in Chapter six. The letters of approach, advertisements, and targeted email are available in Appendix E. Participant Information Sheets are presented in Appendix F Interview schedules are presented in Appendix G.

4.6.3 Patient Recruitment

Those referred to the SBE programme needed to be community-dwelling older people, independently mobile (with or without an aid such as a walking stick), and suffering at least one fall within the preceding 12 months. Four geographically situated venues optimised patient access to exercise classes on five days per week across a city in the UK. Clinical report data highlighted that referred patients were predominately white British (93%), 85% female, and had an average age of 79 years (range = 49 to 96 years). No cohort existed because service efficiency measures meant that, as each patient completed the programme, another replaced them. The rationale for the interview recruitment target of 12 respondents reflected the aim of including the same number of respondents that would attend a single SBE class. It was anticipated that such a sample would

comprise sufficient diversity of experience and perspectives to address the research questions.

Between September and October 2015, 'Systm One', a live and secure NHS database which holds all referrals and records enabled the recruitment of patient interview respondents. The service administrator identified referred patients (n = 47) to all classes across the city as potential respondents. All referred patients received Participant Information Sheets and an invitation letter from the clinical team leader which invited them to contact the service if they were interested in taking part in the study. Once potential respondents had made contact to indicate their interest, KA telephoned them to explain the study, and to arrange an interview. The participant information sheet formed the basis for a discussion about the study's nature and purpose and facilitated the taking of informed written consent at the start of each interview. Study exclusion criteria for patient respondents were the inability to either provide informed consent or to speak English, which was a prerequisite for participation in an interview.

4.6.4 Professional respondent recruitment

A targeted email from the clinical service manager introduced the study and invited the member of staff to contact KA directly if they were interested in participating formed the primary method of recruitment. The protocol design aimed to recruit two members of staff with management or strategic experience to explore the practicability of delivering proposed interventions

in the NHS. Two members of staff agreed to an interview. Additionally, a similar advertisement in the organisation's internal electronic communications newsletter formed the focus group recruitment method. Although flexible, the full capture of opinions and insights in a time efficient manner (Morgan, 2012) can be achieved with focus groups that comprise eight to ten respondents (Sim and Wright, 2002).

The only inclusion criterion for staff participants was that they were healthcare professionals involved in the rehabilitation of older people. This very flexible inclusion criterion had the intention of encouraging a wide range of opinions from different professionals with different levels of experience and qualification so that they could relate to each other's comments and challenge contradictions between belief and practice (Kitzinger, 1994). Equally, focus groups can promote an understanding of the meanings behind events (Leung and Savithiri, 2009). However, due to respondents' differing organisational status, it is easy for a few people to dominate the discussion, skilled moderation is therefore required to ensure the capture of diverse opinions by reducing power differentials (Morgan, 2012). Such competent facilitation also ensures that conversations remain 'on track' (Krueger and Casey, 2015). Before the taking of consent, all respondents received the Participant Information Sheet, and this then formed the basis of the structured discussion to ensure that the consent was informed.

4.6.5 Interview and focus group procedures

An Olympus digital voice recorder (DM670) enabled the recording of all interviews and the focus group. Appendix G provides the interview schedules. All interviews were undertaken between September and November 2015.

4.6.6 Framework Analysis

Predefined codes reflected the overarching aim of this thesis in understanding what affected continuing class attendance and potential interventions to improve the SBE class attendance rates. The FA's predetermined codes were:

1. Exercise facilitators.
2. Exercise barriers.
3. Potential interventions.

There are two phases of the analytic process, data management and abstraction / interpretation (Parkinson et al., 2016). FA was suitable for research with a priori issues, specific questions, a limited time frame, and a pre-designed sample (Srivastava and Thomson, 2009). Analysis by case and code is enabled by systematically reducing the matrix output where rows (cases), columns (codes) and 'cells' provide data (Gale et al., 2013).

By linking data to ideas and back again, coding enabled the development of categories (patterns of codes) and subcategories (Saldaña, 2016). Coding required the interpretation of the interview data which enabled the

definition of concepts, identification of commonalities and mapping polarities to identify the range and extent of a phenomenon (Srivastava and Thomson, 2009). Thus transparent conclusions were facilitated (Gale et al., 2013, Sheard et al., 2013). Informed by a priori design topics, emerging themes, evolving categories, and discussions between KA and KP, a 'working analytical framework' developed. Interview and then focus group data were then 'charted' into the 'framework matrix', sometimes known as the 'analytical framework'.

In summary, therefore, FA was appropriate because it identifies commonalities and differences in qualitative data, before focusing on relationships between different parts of the data, thereby seeking to draw descriptive and/or explanatory conclusions clustered around themes (Gale et al., 2013). Figure 8 detailed the journey for data (adapted from Spencer, L, 2017; Personal communication), as it passes from left to right, so data management turns to abstraction and interpretation.

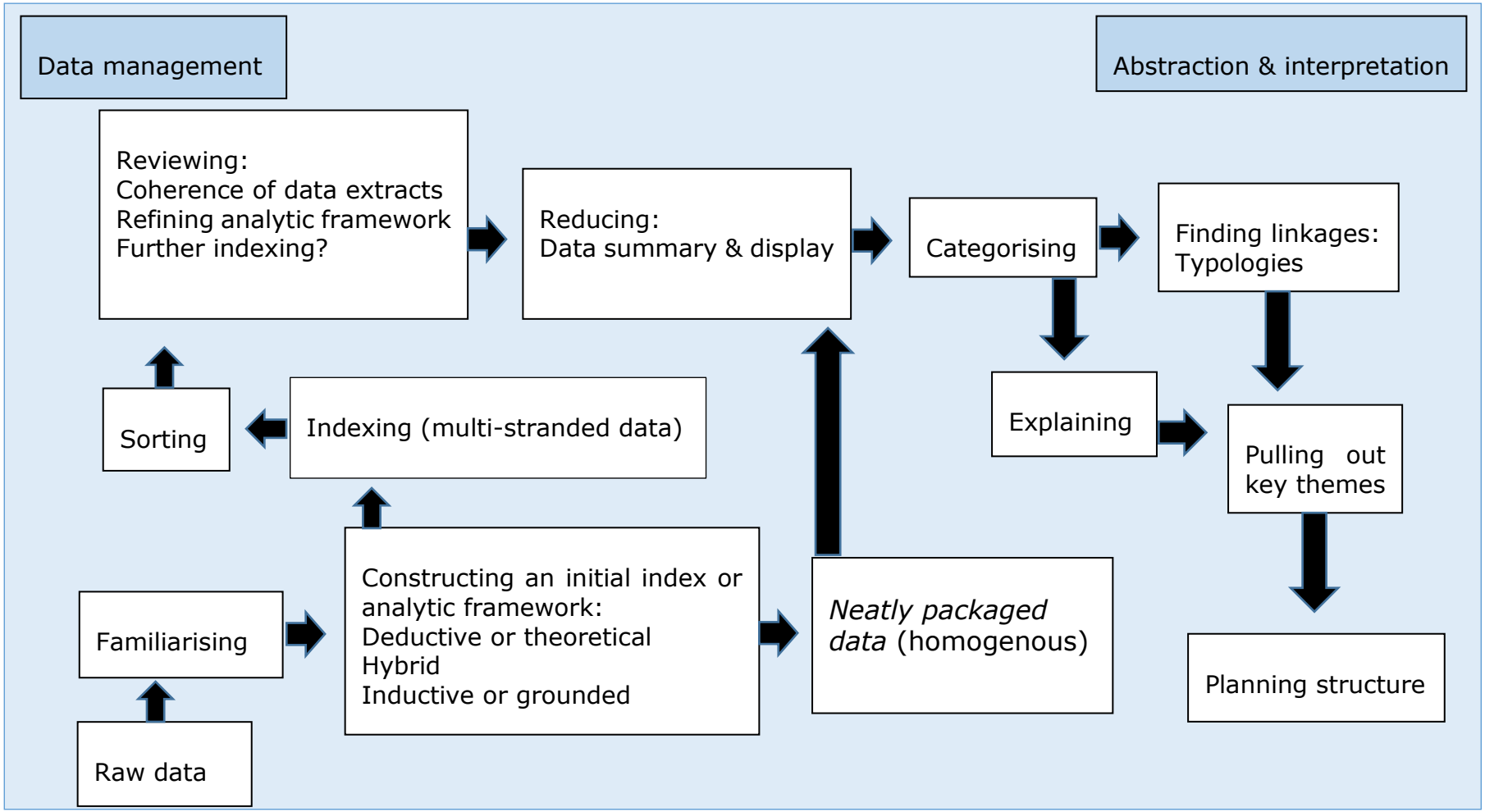


Figure 8: The analytic journey of data

An independent member of University staff transcribed the recorded interviews verbatim as MS Word documents with numbered textual lines. An example of an interview transcript is available at Appendix I. KA then compared the transcript with the soundtrack in real time to correct errors and aid familiarisation. Once reviewed, and during the creation of the matrices, track changes alongside the document's review column enabled coding. To codify is to arrange things in a systematic order, to make something part of a system or classification, to categorise (Saldaña, 2016). Coding represented the annotation of descriptive codes that most commonly represent a word or short phrase. As such, a code might be symbolic, but it captures and sums up the essence of salient features. However, coding risks data fracturing to the extent of a contextual loss. Therefore the report needed to ensure the provision of sufficient detail without being too cryptic.

4.7 Results

This section first details the results from the patient interviews and then the integrated results from the staff interviews and focus group. The first section explores the reasons for respondents' full or partial exercise adherence, or abandonment of exercise and then explores their perceptions of relevant and acceptable interventions. The next section explores the acceptability and relevance of potential interventions from the perception of healthcare professionals.

4.7.1 Perspectives of patients

From a total of 47 patient invitations, 13 potential respondents contacted the service administrator by phone who in turn, passed their details to the researcher. For personal and unclear reasons, one potential respondent subsequently declined to take part. Thus, 12 patient respondents provided informed consent. Pseudonyms were allocated to all interview and focus group respondents to maintain anonymity. Although offered the opportunity to be interviewed at a place of their choosing, all participants chose their homes as the venue for the interview to be conducted. Digitally recorded interviews (n = 12) ranged from 45 to 75 minutes in length. With the exception of Julia's husband, only the interviewee and interviewer were present (table 9).

4.7.2 Review of patient respondents

Table 9 provides details the respondents' characteristics. The demographics for respondents were similar to those of patients referred to the exercise programme. The interviews suggested that all respondents lived with physical or mental health conditions that variably threatened their continued ability to remain independent.

Table 9: Participant characteristics

Name and age	Living status	Completed exercise programme?	Exercise level at point of interview
Patricia 78 years	Lived with husband. Owner occupier: house.	Yes	Regularly went shopping but not formal exercise sessions.
Jane 80 years	Lived alone. Rented cottage.	Yes	Regularly performed home exercises and went walking in the local woods.
Marie 80 years	Lived with husband. Owner occupier: house.	No – withdrew because of spinal pain.	Attended NHS spinal rehabilitation classes.
Sarah 93 years	Lived alone. Owner occupier: house.	Yes	Went walking in the local area with daughter and was keenly awaiting a repeat of the Strength and Balance Exercise programme.
Sylvia 65 years	Owner occupier: bungalow. Lived with partner who also lived abroad for health reasons	Yes	Disengaged with all form of exercise and used car wherever possible.

Name and age	Living status	Completed exercise programme?	Exercise level at point of interview
Brenda 81 years	Owner occupier: house. Long standing widow. lived alone	Yes	Performing home Strength and Balance Exercises and walked to the cities shops whenever possible (approximately 1 mile).
Carol 72 years	Owner occupier: house. Widow and lived alone	No – peer pressure and mental health	Walked dog daily, but did not take part in any other exercise.
Marcia 89 years	Leased apartment in a sheltered complex. Widow and lived alone.	Yes	Performed balance exercises, used a self-purchased treadmill and static cycle in the apartment.
Derek 83 years	Owner occupier: house. Lived with wife	No – withdrew because of hip pain.	No formal exercises, but maintained an active lifestyle. Took a daily walk to the paper shop.
June 74 years	Owner occupier: bungalow. Widow and lived alone	Yes	No exercises and increasingly dependent on family for functional tasks.

Name and age	Living status	Completed exercise programme?	Exercise level at point of interview
Julia 75 years	Owner occupier: house. Lived with husband	Yes	Balance exercises as able. Walked whenever possible.
Ellen 88 years	Owner occupier: house. Widow and lived alone	Yes	Often walked for functional reasons.

Eleven respondents were female with an average age of 80 years, and an age range of 65 years to 93 years. All but two respondents owned their accommodation; one lived in sheltered housing with regular visitors. One respondent previously worked as a factory worker, six worked in an office, three in retail, and one was a health worker. Seven respondents did not hold any formal qualifications, two passed the '11 Plus', two held O Levels, and one held A Levels. All but two respondents were in regular contact with their extended family. Divorced and estranged from her two sons, another respondent lived in an alms-house with no regular visitors. Five respondents lived with a marital or civil partner. Eight respondents were in regular contact with close family through visits or phone calls. Nine respondents were academically unqualified; several justified this by noting that their education primarily prepared them for the workplace. One participant still worked part-time.

For various reasons and to different degrees, four respondents were reliant on others. For example, although independently mobile and able to attend the exercise classes, Marcia and June both had a fear of falling and friends or family members assisted with functional tasks. Equally, Sarah and Brenda relied on others to help clean and maintain their home environment but, by partially fulfilling such responsibilities themselves, expressed a desire to maintain their independence. All four attended the exercise classes because they believed that the exercises would prevent the decline of their independence. Six of the respondents either went walking in woods or around the shops. Three continued to perform home exercises, one was

attending a separate programme, and one awaited the start of another SBE programme. Despite different conditions such as breathlessness on exertion or joint pain, eight considered themselves to be relatively independently mobile. Three were freely mobile with a walking stick.

This section explored the reasons for various levels of exercise adherence and, therefore, there were three predetermined codes for the framework analysis, exercise facilitators, barriers, and potential interventions.

4.7.3 Facilitators of exercise class adherence

Interview findings indicated that exercise adherence has both a cognitive and automatic component. To explain, Derek's, Julia's, Brenda's and Marie's dialogue highlighted that a positive attitude toward exercise aided class attendance, but health challenges impeded a rational desire to remain independent, consequently the importance of class attendance changed. Derek's dialogue illustrated this by identifying a lifetime of discipline and physical challenges (such as running faster in the cross country league), but also arthritic joint pain that was threatening his highly valued independence (Teixeira et al., 2012):

"I'm not going to give in to it. I can sit here all day, I've got bad artificial hips, artificial knees, I've got arthritis coming in my hands. I can sit here and be miserable all day."

(Derek, line 241).

"If I set a boundary, that's what I'm going to do. … if I set myself a task, I'm going to do it."

(Derek, line 544).

Arguably, Derek identified that a physically active lifestyle enabled him to remain independent, nonetheless, he withdrew from the exercise classes because the sessions increased his joint pain (exercise deregulation) (Deci and Ryan, 2002b). In Julia's case, an unrepairable fractured ankle significantly limited her functional mobility. The two cases were similar and yet dissimilar because Julia's impairment was unmodifiable and she recognised that continued performance was essential:

"It was surprising how much, over the weeks, you benefitted. Especially with umm balance because they give you exercises for balance. And I'd found my balance improved tremendously when I went there."

(Julia, line 606).

Events over many years forged a strong self-determination for Jane where, as part of her post-divorce *"new lease of life"* (line 112), she formed a habit of enjoying various sports (Hagger and Chatzisarantis, 2005), and this fuelled her identified regulation to the preservation of her independence:

"I have to keep myself fit" [to do] "all the things that I want to do."

(Jane, line 333).

Long term exercise class attendance would not normally increase where a person exercises for the prevention of falling, an identified reason, because the importance of exercise reduces as the reason reduces. However, Jane

completed the programme because she believed in the value of exercise. Nevertheless, as demonstrated by Marcia's dialogue, a belief in the value of exercise did not always influence class attendance in later years.

Marcia was interested in the arts and politics, only took gentle walks in London's parks, never fulfilled recommended levels of moderate to vigorous physical activity (Public Health England, 2016a), became less active, gained weight, and ultimately suffered several mini-strokes (Transient Ischaemic Attacks). These events impaired her balance with a reduced level of confidence that threatened her valued independence. She completed the exercise programme, and as part of her sustained effort to reduce her increasing level of dependence, purchased a static cycle and treadmill to exercise in her apartment. Similar to Marcia's dialogue, Brenda also prioritised the needs of her family over formal exercise class attendance:

"Running up and down the stairs, running after the kids, playing football, cricket with them perhaps for half hour. Not doing it for the sake of exercise but for what, you know, but just being living."

(Brenda, line 248).

However, Brenda determined that she would maintain her highly independent lifestyle when her husband passed away at the age of 52 years. She valued the interactions with others and continued to work beyond the standard pensionable age of 65 years. A fall and subsequent fear of falling threatened her independence:

"I had a--a silly fall in my kitchen … I tried to open the [oven] door … I finished on the floor… so I finished up at the A&E… and I'd got three broken bones in there. … I don't know that you can stay away from risks, you never know when you're gonna--I mean you can be walking along … I'm very careful the way I walk."

(Brenda, line 791).

Consequently, Brenda modified her behaviours and stated that she attended the SBE classes to maintain her independent lifestyle (identified regulation). Marie, however, attended the exercise class because a therapist recommended it on the basis that it would prevent deterioration as the result of sustaining further injurious falls:

"I didn't want to go backwards"

(Marie, line 509).

"I'm willing to try anything to improve matters, you know. After you've fallen and cracked your ribs, which is painful, don't do it …"

(Marie, line 641).

Marie's dialogue suggested that, where class attendance is encouraged without fully engaging the person in an understanding of the reasons to perform specific exercises, the person might adopt the position that they have enough exercise through their normal activities. Marie consequently found the exercise sessions boring and withdrew in favour of her hobby of shopping:

"I perhaps go out [shopping] at half past nine, and it's half past one when I get back, and I've been walking all that time."

(Marie, line 426).

Thus, these interviews suggested the helpful role of relevant and interesting exercise programmes with clear and unambiguous outcome expectancies (Dishman and Ickes, 1981). In other words, when patients join the programme, they need to embrace the rationale of continuing to attend classes. Accordingly, a potential intervention would have been to appreciate their position relative to exercise and then to discuss possible options so that they could improve their expected and achievable outcome of the SBE programme (French et al., 2014a, Deci and Ryan, 2002b).

Nevertheless, the preservation of independence and the desire to maintain social connections are equally intertwined (Public Health England, 2015a). In particular, Sylvia previously enjoyed attending exercise classes because they facilitated social connections, which suggested the importance of social interactions as a component of exercise engagement:

"I enjoyed being with my friends, and it was just something-- I think if you go in a group you tend to do it."

(Sylvia, line 181).

The SBE programme acknowledged this concept and incorporated 'tea and biscuits' with the ability to discuss problems after each session which facilitated the warmth of *"Esprit de corps"* (Derek, line 760). Both Brenda

and Marcia believed that this sense of support and camaraderie augmented their individual motivation to attend:

"I think people need company."

(Brenda, line 629).

"I think you--you probably enjoy it more. You're doing it as a--as a group, you're not just doing it on your own, which… I mean I c--I can do my machines, but it's on my own. … Seeing other people and knowing that they may be struggling the same as you or more than you or less than you, depending on, you know, what their circumstances are"

(Marcia, line 1079).

Thus, evidence from these respondents suggested that a highly influential factor was the maintenance of physical and social independence. Nonetheless, the data presented in Chapters one and two highlighted a suboptimal adherence rate to exercise classes, and the clear next question related to the presenting barriers.

4.7.4 Barriers to exercise class adherence

Interview data highlighted that highly personal factors such as a fear of falling might facilitate class attendance, but it might also become a barrier without support. As an example, Ellen reported a fear of falling and attended to improve her balance:

"My balance seemed to not be so good, you know. And umm that's really why I went to [the exercise classes]."

(Ellen, line 624).

Nevertheless, a fear of falling might be rational and proportionate to an actual risk of sustaining an injurious fall. However, of the three respondents who withdrew, Derek and Marie did so because of a socially acceptable, but modifiable factor in that of joint pain. Other reasons were less obvious, and arguably more complex in that of apparently unresolved mental health problems; Carol illustrated this. She withdrew from the exercise classes because she was unable to resist a neighbour's unwanted pressure:

"I take a friend into [the local town] on Tuesday, and she was getting later and later, and I was so embarrassed because I was late nearly every day. And then I--I've just given it [attending the exercise classes] up as a bad job now."

(Carol, line 578).

Exploration revealed the reason for this inability to prioritise her own needs above those of others. Carol was the County school sports champion in her teenage years, continued to enjoy competitive exercise in the military, and her strong-willed fiancé sustained this appreciation. However, when she started a family, Carol adopted a passive approach and became increasingly externally regulated with exercise:

"Even going around the gym umm… I was a sort of coward … you know, "come on we'll do this one now." Okay so I went, and we did the bike "right w--let's go and do this one now" like a silly-- lamb."

(Carol, line 457).

When her husband passed away some five years previously, she entered a prolonged period of grief which fuelled a fatalistic outlook:

"I'm not doing anything… now you've pointed that out. And this is all since my husband died."

(Carol, line 517).

Consequently, she preferred to exercise on her own at home, but she lost her source of motivation to exercise because her husband had passed away. Carol consequently knew that she was unlikely to perform recommended exercises, and would probably:

"… sit down and … fall asleep."

(Carol, line 932).

This finding suggested that the provision of appropriate support could have prevented Carol's abandonment of the exercise programme. June and Sylvia's dialogue emphasised this. Both respondents completed it, but arguably, previous events caused an ambivalent attitude to exercise which ultimately led to disengagement with physical exercise. Alongside long standing physical health issues, June experienced the sudden and unexpected deaths of two husbands. These events arguably resulted in signs of an ambivalent and fatalistic attitude to functional activities of daily

living and her quality of life. Sylvia sustained a complicated femur fracture during a Zumba class. She fully adhered to long term rehabilitation, but anger at her curtailed independence meant that she disengaged with long-term physical exercise:

"I'm negative because I--I can't-- I don't face up to things that I can't--I can't do. I don't--" (line 594) … "What's going to happen to me now?" and I think that's when I started to become a bit more negative" (line 625)... *I feel terrible I … it's been the biggest thing in my life … I'm struggling to get over it. … I put obstacles there to not make me do it. I'm cross with myself … which is not really--I shouldn't really be cross with myself. … I don't think I'm facing up to it"* (line 799).

(Sylvia).

Together, these findings suggested that both enablers and inhibitors were highly personal to the respondent. Physical and mental health age related problems also often impacted on a determination to remain independent.

4.7.5 Potential interventions

The next section presents respondents' ideas about how OPREE could improve SBE attendance. This first section presents material relating to patient respondents' accounts of acceptable and useful interventions. The second part relates these findings to those of professionals' views to understand those approaches likely to be used precisely because they

viewed them as relevant, useful and acceptable. During the patient interviews, an open question was used to explore useful interventions to improve SBE class attendance:

"We are trying to develop a programme that will help older people to attend exercise programmes. What features do you think that it should have?"

Brenda and Derek's dialogue suggested that relevant, and interesting (Deci and Ryan, 2002b) classes that transcend a highly common challenge (Department of Health, 2011d), a desire to remain sedentary, can facilitate the habit of attending exercise classes:

"The nature of man is to be lazy; it's the nature of the beast."

(Derek, line 995)

"I think to do the exercise properly you've got to be really interested in doing it. You've really got to want to do it… Haven't you?"

(Brenda, line 1228).

These findings suggested that to overcome such 'laziness', programmes need to be of interest to the specific person. Therefore, the indication was that OPREE should adopt a highly bespoke approach.

4.7.6 Continued, personalised support and feedback

Derek's dialogue indicated a determination to remain independent by attending the exercise programme, but did not seek appropriate support for an exacerbation of joint pain and withdrew from the SBE programme. A possible counter-argument could be positioned that Derek used pain as an acceptable reason to discontinue attending the exercise classes, but his dialogue indicated that this was not the case. Had he been contacted, the challenge to his continued attendance could have been identified, and in parallel with exercise class adherence, he would have received appropriate support that might have facilitated a reduction in pain. Marie's dialogue reflected this finding where she withdrew because of pain that could possibly have benefitted from highly personalised support. June, Carol and Sylvia's accounts also reflected these findings where they would have benefitted from the identification of obstacles to class attendance. Once identified, appropriate support could have been identified.

4.7.7 Signposting to appropriate sources

Chapter three's systematic review of potential interventions highlighted an ongoing international intervention that has been proven to increase exercise adherence, that of appropriate signposting (Ministry of Health, 2016). Therefore, open questioning explored the acceptability of this strategy.

Both Derek and Marie withdrew from the exercise programme, but appropriate signposting to a pain management service might have arguably prevented this. As further examples, Julia noted the exercise class instructor's ability to identify and direct participants to sources of help:

"She told her about something that she could do through the doctors, and I thought "well that was good." And then somebody else was struggling walking a bit, and she said "Oh I-- we'll organise-- go to so and so, and we'll get you sorted out with a frame" and then when the lady got the frame, and she came and you know you could see she was uplifted, "oh I've got this" and it sort of helped--it--it helped so she was--she was doing the class."

(Julia, line 1378).

Despite completing the SBE programme, Brenda continued to display a heightened fear of falling. Such a fear of falling represents a risk factor to further falls and in turn re-referrals to another exercise programme. Further, by avoiding movement, the programme benefits are reduced and in some cases reversed, which in turn forms a barrier to class attendance. In Brenda's case, she would have benefitted from a therapeutic discussion to understand these challenges.

Consequently, these findings suggested that the strategy of signposting might be acceptable and was, therefore, worthy of further investigation.

Table 10 briefly summarised the findings of patient interviews.

Table 10: Illustrative Framework Analysis of patient participants

Category	Sub-category	Illustrative quotation
Facilitators	Maintenance of independence in the presence of various health conditions	"I have to keep myself-- I don't-- it's me, I have to keep myself fit … so that I can do all the things that I want to do" (Jane, line 333).
	Social interactions	"I think you--you probably enjoy it more. You're doing it as a--as a group, you're not just doing it on your own, which… I mean I c--I can do my machines but it's on my own" (Marcia, line 1073).
	Functional factors	"It's a case of making myself go out and having to go out, I mean you do your shopping. I mean, you--you know, you've got--you've got to go out, haven't you? ... "I don't want to gi--give up completely, you know" (Ellen, line 475).
Barriers	Injury and the perceived consequences of ageing	"I feel terrible because umm it's--it's [the fractured leg] been the biggest thing in my life … I'm struggling to get over it, and my family insists that I can do more than I do, and I don't do it. … I put obstacles there to not make me do it [exercise]" (Sylvia, line 496).

Category	Sub-category	Illustrative quotation
	Personally perceived or preferred priorities/factors	"I perhaps go out [shopping] at half past nine, and it's half past one when I get back, and I've been walking all that time … To be honest, err I would say I'm lazy. So I go in the car to the Park and Ride" (Marie, line 426).
Potential interventional components	Continued, personalised support and feedback	"They put you at ease, and all the while they're encouraging you… to do these things. But only within your limits" (Brenda, line 838). "Well until somebody comes and asks you those questions, you don't really know just what your capabilities are, do you" (Marie, line 1322).
	Signposting to appropriate sources of help	"She told her about something that she could do through the doctors, and I thought "well that was good." And then somebody else was struggling walking a bit, and she said "Oh I--we'll organise-- go to so and so, and we'll get you sorted out with a frame" and then when the lady got the frame, and she came and you know you could see she was uplifted, "oh I've got this" and it sort of helped--it--it helped so she was--she was doing the class" (Ellen, line 1378).

4.8 Perspectives of professionals

This next section details the a priori inquiry of understanding what health professionals consider to be relevant, acceptable and useful interventions that can promote engagement with the SBE programme. Throughout, all respondents independently concurred with patient suggestions that potential interventions should be personalised and promote an understanding of the reasons to exercise. Respondents also supported new practical ways of working alongside signposting to more appropriate activities. The protocol planned for two Focus Groups (FG) with members of staff to explore the acceptability of these interventions. Although widely advertised, only one group of six members of staff were recruited. Both interviews and the FG occurred within NHS office premises. The FG took place in February 2016. Questions focused on relevant and acceptable interventions. The schedule of questions is in Appendix G.

4.8.1 Review of professional respondents

Both interview respondents held graduate level qualifications. Gemma had worked as a non-clinical strategic manager for ten years. The second interview respondent, Richard had worked as a physiotherapist for 11 years. Most (n = 4) focus group respondents were physiotherapists. In addition, one was a nurse and another a clinical manager. All clinical respondents were experienced in the rehabilitative health care of the older person with at least nine years of therapeutic practice (range 9 to 32 years, mean 19.9 years).

4.8.2 Relevant interventions

All respondents asserted that services needed to be demonstrably acceptable, useful, sustainable, effective, and theoretically underpinned:

"We need to form sustainable, evidence based, but person-centred and personalised strategies."

(Focus Group, line 80).

Interestingly, all professional respondents acknowledged an increased emphasis on the provision of diverse services that reflect many patients' desire for consumer choice:

"We perhaps need to look at this and try something different to help us identify those reasons why patients aren't currently taking our advice and perhaps changing how we go about things to try and change the outcome there."

(Richard, line 766).

Members of the FG also acknowledged the need to innovate through new ways of working that patients found to be acceptable:

"We can't just stick to the traditional route. People want choice so that they can have a wider range of potential therapies."

(Focus Group, line 87).

Notably, though, some FG respondents also revealed a concern that, as a result of increasing frailty, many older people are:

"Too old to exercise."

(Focus Group, line 34).

"We can't just send them off to the gym. It's a generational thing; they don't want to spend time in the gym with 'tank heads' lifting heavy weights."

(Focus Group, line 38).

The consequent suggestion was that, while health professionals acknowledge the complexity of older peoples' needs, they understand the difficulty of forming clearly effective interventions. Illustrating this, both of Gemma's parents were recommended to attend cardiac rehabilitation exercise classes, but were reluctant despite understanding the programme's effectiveness. Gemma took the time to appreciate their values, fears and perceptions, and was consequently able to encourage attendance:

"There was something about the perception of what that exercise class was and … being seen as vulnerable perhaps, I don't know, or with people that they didn't want to go to or participate with."

(Gemma, (Manager) line 79).

"The thought of going in those plimsolls to a gym with a load of other people was more off-putting than the outcomes that she was telling him that they would achieve."

(Gemma, line 113)

Several FG respondents further reflected this challenge of empowering older people to engage with exercise by encouraged active lifestyles in any form and for any duration. Nonetheless, they disclosed a belief that many patients treated exercise as *"something that is done to them rather than with them"* (Focus Group, line 81). Analogously, an older person might passively take medication as instructed by the GP. The group believed that such passivity should be reduced to increase SBE attendance:

"We need to look at whether someone is an exercising or non-exercising person, and that it is hard to change"

(Focus Group, line 36).

"I guess some things will work for some people and some things will work for another person."

(Richard, (Physiotherapist) line 790).

FG respondents also asserted that a given person's "disposition" (line 81) and potential "forgetfulness" (line 83) sometimes resulted in withdrawal from exercise programmes. They, therefore, suggested that these personalised strategies needed to consider mental health and age-related cognitive decline challenges.

4.8.3 Acceptable interventions

When focussing on OPREE's potential effectiveness, all professional respondents indicated the need to ensure the facilitation of patient driven purposeful and goal focused physical activities. These findings suggested

that potential interventions should adopt an approach that identifies and addresses participants' needs and values. Subsequently, OPREE could explicitly link physical exercise and complementary activities by identifying pleasurable rather than arduous exercises. In turn, exercise programme adherence rather than compliance might be facilitated (Hay-Smith et al., 2016):

"I think the person needs to be fully understanding of why they're doing it [exercise], of the purpose and I think umm without that full understanding and insight into a particular like I say activity."

(Richard, (Physiotherapist) line 21).

Continuing this, Richard identified that the language used during patient consultations formed a potential challenge to exercise engagement. An exercise provider might focus on motivational levels and set achievable yet meaningless goals, but an older person might relate exercise to that of social and functional ability. Thus, negotiation alongside enablement of an understanding of the value and purpose of the exercise is favourable. The aim of such negotiations would be to enable engagement between providers and patients in productive discussions of each other's goals and negotiate a mutually acceptable and realistic strategy to achieve these: concordance (Pollock, 2005). However, informal dialogue strongly indicated that the goal is to educate patients so that they accept the professional viewpoint. Consequently, OPREE would not only need to put strategies in place through inter-agency working, it would require education of professionals so that

they become aware of the problems resulting from ineffective communication.

4.8.4 Useful interventions

As a component of the investigation into sustainable interventions, the scoping review presented in Chapter two identified the BCW (Michie et al., 2014) as a possibility. FG members were invited to discuss its acceptability as an affordable framework that could lead to improvement of adherence to exercise classes. Once outlined, respondents asserted that the BCW was complicated and *"too theoretical"* (Focus Group, line 50). They believed the tool to be too "concrete" (Focus Group, line 57), and although newly qualified exercise providers could use it as a "reference tool" or an *"aide memoir"* (Focus Group, line 67), the group unanimously asserted that clinical practice would not benefit from the framework. Thus, no further exploration of the model occurred.

Nonetheless, the structured approach of the BCW was seen to be helpful. One respondent identified the value of a fully validated hip arthritis framework that did not reduce service demand, but improved patients' outcome expectancy improved and therefore engagement with rehabilitation:

> *"It is structured, but patients are happier with the outcome."*
>
> (Focus Group, line 76).

This supports separate findings which emphasise that adherence is promoted by the belief that an intervention will be effective, as well as the belief that the individual is capable of following the requirements of the intervention (Picorelli et al., 2014). The FG respondents also acknowledged that such strategies would involve the development of inter-service and *"inter-organisational networks"* (Focus Group, line 90). As a strategic manager, Gemma offered insights that facilitated an understanding of potential new ways of working to increase engagement:

"We could perhaps look to at least help people organise something for an ongoing period of time umm without actually providing financial support to that or overseeing that, but just to help them organise that in an initial stage and let them take ownership of that and run with that themselves"

(Gemma, line 512).

The risk here though, was twofold. First, Gemma's idea did not actually represent appropriate signposting, but she spoke as a strategic manager, not a clinician. Second, Gemma's idea might become synonymous with an assets based approach. Health assets are defined as any resource which enhances the ability of individuals or groups to maintain and sustain health and well-being and to help to reduce health inequities. Such assets can operate at various levels which facilitates people to use their own skills, knowledge, and lived experience to join with the aim of achieving positive change (Morgan and Ziglio, 2007). Such an approach was outside the remit of this thesis and was therefore inappropriate.

Signposting is founded on an understanding of the person's needs, and represents a continuum from the simple giving of a leaflet to the broader process of collaborative and person-centred enablement. The process requires the identification and engagement of individuals, correctly offering information in the right way, and understanding the outcomes and impacts of signposting (British Red Cross, 2015). While such inter-organisational working is supposed to be happening, Gemma's dialogue reinforced informal suggestions barriers that OPREE would need to negotiate:

"I think we're a way off there personally. I mean I think that's very dependent on if you've got a really forward thinking leader"

(Gemma (Manager), line 458).

As an example, the literature advocates frequent mobilisation and strengthening exercises to reduce joint pain (Hochberg, 2015), but several patient respondents withdrew because the exercises caused pain. Partnership working might have optimised the provision of appropriate pain relief. Additionally, several patient respondents reported mental health problems that might benefit from signposting to appropriate talking therapies. In both scenarios, the provision of appropriate strategies may have expedited a return to the exercise classes, but the full supportive infrastructure was not currently available. Further, services often do not measure outcomes from Signposting (British Red Cross, 2015). Table 11 briefly summarised the health professionals understanding of relevant, acceptable and useful interventions.

Table 11: Illustrative Framework Analysis of health professionals

Category	Sub-category	Illustrative quotation
Relevant interventions	Examine compliance versus engagement	"I think the person needs to be fully understanding of why they're doing it, of the purpose and I think umm without that full understanding and insight into a particular like I say activity" (Richard, line 20).
	Maximise and ensure personalisation and acceptability for all	"There would always be something that an individual would like to get back to doing. How specific that is umm… may vary and one individual might have a very specific target, some again might be less specific with that but I think the potential for there to be a motivational driving factor is still there" (Richard, line 109).
	Personally perceived or preferred priorities/factors	"We need strategies that are person centred. You know, personalised and reflect a person's disposition" (Focus group, line 80).
	Signpost to more appropriate or acceptable activities	So not--so it's not as though the patients perhaps feel as though they're cut loose and then on their own and "that's the end of my--end of my rehab, that's it. I'm on my own" and perhaps signpost" (Richard, line 527).

Category	Sub-category	Illustrative quotation
	Injury and the perceived consequences of ageing	"There was something about the perception of what that exercise class was and being with other people, and being seen as vulnerable" (Gemma, line 83).
Acceptable interventions	Support autonomy	"It's something to do, somewhere to go, but it's an organised, managed something with people rather than you know, having to exercise yourself" (Gemma, line 679).
	New measurable ways of working	"We have very positive outcomes and patient experience, 'cause obviously people talk a lot about patient experience but it's those physical outcomes and demonstrating them I would say again-- umm against admissions, mortality rates that it becomes really challenging really because we all know that people enjoy it, have an instant outcome, but I don't think we're there yet on demonstrating that umm longer term impact" (Gemma, line 310).
	Evidence-based behaviour regulation	"I think the evidence for regular physical activity is there in terms of improving quality of life, improving function, umm reducing umm risk of

Category	Sub-category	Illustrative quotation
		various sort of long term conditions. I think it's just about the extent to that message is being repeated for this point, I think it comes down to education (Richard, line 146).
	Examine new ways of working including Signposting to more appropriate or acceptable activities	"I guess every individual is different and so perhaps at the end of such programmes we need to get a better understanding of patients' self-efficacy and whether they feel that they are in a position to manage this themselves and those that are, fantastic, great. They can get on with it without the need for further support but perhaps we do need to examine those people who perhaps don't feel the case and they perhaps need further input at that point umm which may ultimately be more cost-effective than them just being left to fend for themselves to only go through the cycle of acute illness (Richard, line 444).
Useful interventions	Sustainable interventions	"It's about trying to reduce the demand on--on a particular organisation and on their resources. So that's where I think the real change needs to perhaps come" (Richard, line 393).

Category	Sub-category	Illustrative quotation
	Activity versus outcome	“I think there is an element of people having to take responsibility for themselves” (Richard, line 492)

Signposting is intuitively logical and acceptable, but awaits systematic and robust evaluation. Therefore the potential for appropriate signposting as a potential component of OPREE clearly warranted further investigation, however, its effectiveness was unclear. An example of the early Framework Analysis is available at Appendix J.

4.9 Discussion

International literature (DeMaria, 2012) and local data identified a common challenge of noncompliance with health interventions. This study successfully explored and identified patients' understandings of the factors that influenced older people's adherence to the strength and balance exercise programme. Interview data supported previously stated research findings, which indicated that factors influencing older peoples' exercise class adherence are far from clear or straightforward and related with SDT, the underpinning theory of this thesis (Deci and Ryan, 2002b). For instance, socio-emotive factors (Reed and Carstensen, 2012) formed exercise habits (Hagger and Chatzisarantis, 2005). The enjoyment of a challenging physical activity however, often changed to that of exercising to improve health and sociality (de Bruijn and Rhodes, 2011). Of note, KA continually acknowledged the need for reflexivity, an attitude of continually attending to the context of knowledge construction. In particular the effect of his background and position, the investigation's angle, choice of methods, and the most important findings, framing and conclusions. Therefore,

unconscious bias was made more conscious in forming appropriate conclusions.

Findings reinforced the need for a person centred design that could potentially increase OPREE's ability to increase class attendance (Hibbard and Greene, 2013). Such designs are arguably aspirational and, without the promotion of self-management support mechanisms, often fruitless. The findings indicated that OPREE would not be successful if it merely aimed to increase attendance by promoting adherence because this involves hidden variables. As an example, a study highlighted that the loss of social support contributed to dropout from exercise classes, especially in women (Pridgeon and Grogan, 2012). Therefore, OPREE needed to support exercise engagement. Evidence and experience increasingly shows that those people who are more confidently able to effectively manage their health, are more likely to adhere to interventions such as exercise groups (Hibbard and Greene, 2013). Thus, to increase class adherence, the suggestion was that OPREE needed to embrace multiple domains including the tailoring of information and education, and facilitating the provision of appropriate support (de Silva, 2011). This approach requires inter-organisational coordination in engaging patients in making decisions while offering emotional, psychological, and practical support (Eaton et al., 2015).

The findings from all interviews thus indicated that two changes could increase adherence to the exercise programme: improved communication and integrated working.

4.9.1 Communication

While SBE attendees require a continuing motivation and habit (Verplanken and Melkevik, 2008), subjective norms and the perceived ability to perform the exercise often drive adherence (Ajzen, 2015). While SBE classes aim to optimise function and well-being (Chartered Society of Physiotherapy, 2018), attendees require specific support that enables them to engage with the rationale of continually doing so (Rowlands et al., 2015a). Consequently, these findings indicated that OPREE needed to improve health literacy through understanding and meeting the given person's individual needs (Rowlands et al., 2015a, Nutbeam, 2008). By using a strategy that continually supports older peoples' needs, the professional might be able to increase adherence by positively influencing change through the recognition of life events (Ntoumanis et al., 2018).

Whilst this would seem logical and common sense, health professionals often inadvertently promote an introjected view of exercise by communicating the benefits of exercise without fully ensuring health literacy. By implication, many professionals do not consult their patient's beliefs about why they should not exercise. Thus, merely raising the consciousness of the need to attend the exercise classes is inadequate. These findings indicated that OPREE needed to acknowledge exercisers' feelings and perspectives, encourage choice, and nurture goal driven choices (Reeve and Jang, 2006, Hancox et al., 2015). Such demands require an understanding of older people's positive attitudes, beliefs, prior exercise experience, family support and group cohesion (Hawley-Hague et

al., 2014). Underlying reasons for ambivalence toward engagement require identification and resolution (Hardcastle et al., 2015) so that competing demands (Newson and Kemps, 2007) are understood and goals accommodated while shaping changing priorities (Normansell et al., 2016). Such goals should incorporate the perceived improvement of competence to safely exercise, but also support the belief of safe competence to exercise autonomously; the absence risks exercise abandonment.

Several examples, illustrate these suggestions. A systematic review (Noice et al., 2014) highlighted that successful ageing (Hawley-Hague et al., 2014) can be enabled through the identification of a choice of motivating and enjoyable physical activities. Interview data investigated the normalisation of physical activities one year after a cardiac event (Köhler et al., 2016) and found that, with the passage of time, the identified need to exercise changed as goals changed. Finally, researchers investigated adherence to post hip fracture rehabilitation (Resnick et al., 2008) and demonstrated optimal short-term adherence, which reduced as their participants recovered.

Accordingly, the recommendation is that providers of exercise, support autonomous exercise performance by supporting their participant's particular needs (Ntoumanis et al., 2018, Hancox et al., 2017) through ongoing feedback and a focus on positive information (Reed and Carstensen, 2012). Although, this might seem obvious, findings reported in this thesis support the literature which points out that exercise providers

often focus on the effectiveness of the specific intervention at the cost of the quality (Tolan, 2016) of needs supportive communication.

4.9.2 Integrated working

Findings from this study highlighted that, had their distinct needs been supported, several respondents would have continued attending the SBE classes. As examples, two respondents would have benefitted from a medication review by their GP that would have optimised their pain management. Several respondents displayed signs that they would have benefitted from talking therapies. Additionally, the preparatory evaluations reported in Chapter one, reported that two interview respondents withdrew from the exercise class because of anxiety or depression. Appropriate signposting could have quickly addressed these challenges and expedited a return to the classes.

Signposting is a logical new intervention that is yet to undergo formal and rigorous testing in relation to the UK's health and social care setting. National (Department of Health, 2016) and regional policy documents advocate the concept because it has the ability to proactively prevent exercise class abandonment. For example, the Nottingham and Nottinghamshire Sustainability and Transformation Programme (Pearson, 2016b) called for new ways of working. Nevertheless, to the best of knowledge, it has not been investigated or evaluated in the context of community dwelling older peoples' rehabilitative exercise engagement. Of

the five key areas, prominent domains are wellbeing, alongside the promotion of independence and self-care:

"People have told us that they want support to stay well and independent, to be able to care for themselves, and they want their care to be more joined-up and delivered close to home where possible."

(Pearson, 2016b) (p 5).

Dialogue within the interviews and FG supported this priority. Specifically designed to improve adherence to exercise programmes, appropriate signposting has been utilised in the UK (Langer et al., 2014), used in New Zealand since 2000 and repeatedly audited with positive results (Ministry of Health, 2016). The Green Prescription in New Zealand utilises signposting and promotes exercise adherence. The GP first signposts the patient to an exercise professional who has the ability to provide ongoing support, and who in turn signposts to appropriate sources of help. However, their infrastructure has been formed to specifically facilitate this. Therefore, if OPREE were to fully utilise signposting, it would require optimal levels of integrated working, but interview data suggested that significant obstacles exist.

A systematic review on the factors that promote and hinder health and social care services joint working demonstrated a small evidence base that largely comprised small-scale evaluations of local initiatives which are often of poor quality and poorly reported (Cameron et al., 2012). No evaluation studied included an analysis of cost-effectiveness. Therefore, while

seemingly common sense, a rigorous evaluation of the acceptability, and usefulness of appropriate signposting was justified in the feasibility study.

4.9.3 Strengths and limitations

This study had its strength in that the primary investigator was an experienced physiotherapist who understood the nature of exercise classes for older people. Additionally, preparatory work enabled the completion of a literature scoping review, and a systematic review which facilitated and directed the protocol's formation and the theoretical underpinnings for undertaking interviews as the means of qualitative data collection. Analysis was facilitated with FA, a highly validated and relevant analytic method (Srivastava and Thomson, 2009).

Two limitations require acknowledgement for transparency. Immediately before the focus group, the recorder failed to operate. Rather than abandoning the focus group, KA took detailed notes and typed them up immediately after the session. Therefore although captured, data quality were impaired. Although KA considered that the data could be validated by allowing respondents to confirm their dialogue, such authentication has the potential to change data; therefore, this was not attempted. Secondly, KA acknowledged the possibility of interview self-selection. Self-selection bias arises where individuals select themselves into a group, and in the case of nonprobability sampling, this potentially causes a biased sample. Nevertheless, recruitment for this Doctoral study was enabled by 'Systm

One', and the features of appropriate patients who declined the service, but were potential participants were not captured. Consequently, it is possible that patient respondents were motivated to exercise which might skew the findings. It is not possible to know the reasons why people declined the offer of the exercise classes or why they withdrew, but data presented in Chapter one indicated that many legitimately withdrew or abandoned exercises because of health reasons. It is recommended that future research implement an appropriate recruitment strategy to capture the understanding of why some older people decline a referral to a highly evidence based exercise intervention.

Furthermore, the interview and focus group respondents were unrepresentative of the wider healthcare organisation within which this study was set. All attempts were made to recruit NHS staff involved with older peoples' care. Nonetheless, those who did respond provided relevant insights, and a qualitative study does not seek to generalise findings.

4.10 Conclusion and recommendations

This study met the stated aim of exploring the factors that influence older peoples' exercise engagement and those acceptable strategies for increasing engagement with rehabilitative exercise regimes. The primary objective of the qualitative study was to understand the reasons that older people fully adhere, partially adhere to, or abandon the SBE programme. Interview data highlighted that nine respondents completed the exercise

programme. Of those respondents who withdrew, all three did so because of health reasons. Conversely, while several respondents were motivated to exercise, they did so because of an identified need – preservation of health (physical and mental) and social independence.

Separate research conclusions propose the concept of habitual exercise as the result of ingrained values attitudes and beliefs, this study's findings support those conclusions, but because the sample was small, a firm unequivocal conclusion could not be drawn either way; this would require a more extensive study. The secondary objective was to understand interventions that older people consider to be relevant, acceptable and useful in the promotion of engagement with the strength and balance exercise programme. All respondents reported that a communication strategy that could support participants' particular needs might improve their ability to continue adhering to the exercise programme, and in due course, engage with exercise. Findings from this study, therefore, supported that of the systematic review findings (Chapter three) that study participants might benefit from a strategy that explores and supports the given person's capability to continue attending the exercise classes alongside appropriate signposting.

The next Chapter, Chapter five describes the formation of OPREE by synthesising previous work from the systematic review, the qualitative interviews, and the focus group. Chapter six then details the testing of OPREE in a feasibility study.

Chapter Five: Formation of OPREE

5.1 Summary

This Chapter synthesises the findings of the previous Chapters and models an intervention designed to improve Older Peoples' Rehabilitative Exercise Engagement (OPREE). A combination of the template for intervention description and replication (Hoffmann et al., 2014) and the Medical Research Council's framework for the development of complex interventions (Medical Research Council, 2008) is used to enable a thorough discussion of OPREE's development.

5.2 Introduction

This thesis has its roots in an NHS clinical problem in that of sub-optimal exercise class adherence. Despite the well-publicised health and social benefits of exercise, data presented in Chapters one and two highlighted older people's sedentariness and a tendency to disengage with physically active lifestyles. Therefore many older people require sustained support because re-engagement with an active lifestyle is not simple. Chapter three explored potential published interventions to increase exercise engagement but did not identify one single and appropriate published intervention. Chapter four investigated influential factors and possible interventions to improve exercise participation from patients and clinician views. The study

in this Chapter aimed to model a programme that the UK's NHS could potentially provide to help older people engage with the prescribed exercises which have been advocated in response to growing frailty and injurious falls as the result of sedentary behaviour (Theou et al., 2017).

Following a description of the context of the intervention, this Chapter synthesised the findings of the previous Chapters to develop the OPREE intervention.

5.3 Context of the OPREE intervention

OPREE is an add-on intervention to an existing exercise programme. In the development of OPREE, the decision was made that it needed to be contextually understood. Therefore the exercise classes, programme provider, patient eligibility criteria for the exercise classes, as well as attendance issues will be outlined in the following sections.

5.3.1 Exercise classes as the context

This section details the Strength and Balance Exercise (SBE) classes because they represented the chosen context for OPREE's development. At the time of this thesis, the SBE programme delivered in Nottingham lasted twenty weeks, 60 to 90 minutes per class. Transportation was not provided as part of the programme, and patients could choose from one of five geographical locations that were chosen to provide good accessibility. A

rolling programme operated where new entrants join when another member completes the programme; this meant that referral frequency also predisposed choice. As required, family members were encouraged to support (and join in). Identification of recent falls or unexplained injuries or ailments occurred during the initial phases of each class, and then participants exercised for 45 to 50 minutes. Exercise sessions were followed by a led health education discussion with 'tea and biscuits'.

Although flexibility was permitted, all classes followed a replicable schedule:

- Warm up – circulation booster, flexibility movements of the spine (lateral and rotation) and ankle, and chest, shoulder, hamstring, and calf stretches.
- Endurance – aerobic. The aim is to maintain a target heart rate for the exercise but to avoid the aerobic curve: created by a rapid reduction of intense cardiovascular exercise. While the curve is the most effective cardiovascular exercise, it burns more calories; a mechanism that is not always optimal in an older exercise population.
- Balance – static (for example, feet together with eyes shut and minimal contact with supporting chair), and dynamic (for example, side toe-tapping, sways, lunges (side and forward).
- Seated resistance – usually with graded resistance exercise bands. The grade is decided during ongoing grip testing with the use of a modified Oxford Scale (Porter, 2013) (0 = no grip; 1 = twitch; 2 = weak grip; 3 = moderate grip; 4 = moderate grip; 5 = good grip).

Exercises are designed to maximise function (for example, back strengthening, chest press, leg press, leg abduction, wrist twist).

- Backwards chaining – as able, participants are gradually trained to get onto, and off the floor with the use of this particular technique.
- Floor-work – as able, participants are trained to perform floor-based exercises such as leg extensions and 'four-point kneeling'.
- Cooldown – lowering of circulation, stretches (chest, shoulder, hamstring, calf), adapted Tai Chi.

5.3.2 SBE provider

At the time of this thesis, KA oversaw the delivery of the Nottingham SBE programme. All providers, including KA, undertook nationally recognised (Royal College of Physicians, 2016) and appropriate Specialist Postural Stability Instructor (SPSI) training (Dinan, 2004) with a total duration of about 150 hours. The SPSI training facilitated the ability to establish and provide a consistent quality-assured community set SBE programme.

5.3.3 SBE patient eligibility criteria

Patients were eligible to attend SBE if they

- Had suffered at least one fall within the preceding 12 months,
- Could follow simple commands,
- Could perform the TUG test in less than 40 seconds,

- Could march on the spot (with physical support if required) for one minute and score ≤14 on the Borg Rate of Perceived Exertion scale (Borg, 1982),
- Could attend venues without NHS assistance.

Exclusion criteria were:

- The patient's medical condition or state contraindicates exercise (for example uncontrolled hypertension, unstable angina).
- The patient exhibits behaviours likely to endanger themselves or others.
- The patient is unable to follow simple commands despite provided support.

5.3.4 Retrospective SBE attendance data

To understand the context and trends which the SBE programme was set, data were retrieved from 'SystmOne', the NHS database that processes referrals. Retrieval occurred between 1st of December 2014 and 28th of January 2016. Referral ages varied from 49 to 96 years; the most frequent patient age (mode) was 83 years. Of those attending ≥2 sessions the range was slightly narrower (range 52 to 93 years), but the mode was marginally higher at 85 years. For unknown reasons but suggesting a higher, age-related precedence, only 36.7% of patients in their 70s attended ≥2 sessions, but 75% of patients in their 90s and 73% of patients in their 60s attended ≥2 sessions. Of patients in their 80s, 67.5% attended.

5.4 Methods

The evaluation of interventions is a major research activity, yet the quality of descriptions of interventions in publications is sometimes poor (Hoffmann et al., 2014). The desciption of interventions involves more than a labelling of the components. The aim of this thesis was to develop a multicomponent intervention that was theoretically considered, evidence-based, specific to the improvement of older peoples' exercise class adherence, and acceptable to those receiving and delivering the intervention. The literature reviews, interviews and focus groups enabled the synthesis.

Throughout the development of this thesis, the findings of the systematic review, focus groups and interviews presented in the previous Chapters were discussed in detail by the student (a highly experienced physiotherapist) and a team of expert supervisors: a medical doctor, occupational therapist, psychologist and social scientist. Monthly supervision meetings were recorded on a supervision sheet. Wherever possible, all three supervisors attended the meetings with KA; an example is available in Appendix N. At the end of each session, goals were set and the next meeting arranged.

5.4.1 Complex interventions

The Medical Research Council's (MRC) framework for the design and evaluation of complex interventions to improve health (Campbell et al.,

2000, Medical Research Council, 2000) emphasised the significance of rigorous intervention development. The cyclical model highlighted that components of a complex intervention are formed throughout all of the evaluation stages, and that OPREE is a complex intervention. As outlined in the MRC framework (figure 9) (Medical Research Council, 2008), the stages of development, testing, evaluation and implementation were used to explore relevant theories to underpin the OPREE intervention (Chapter two) as well as identify the essential intervention components (Chapters three and four).

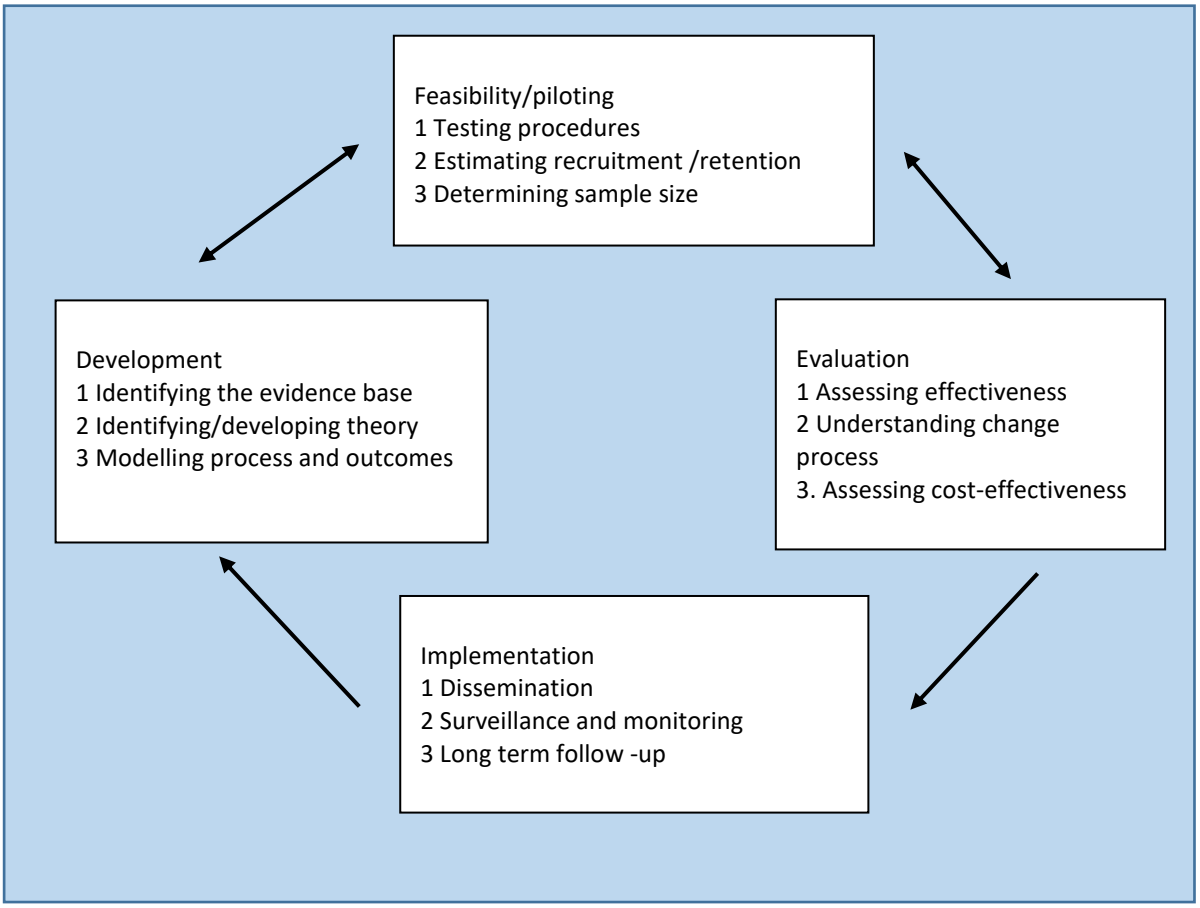


Figure 9: Intervention development processes

Although they may not follow a linear sequence, the process of developing and evaluating a complex intervention has several phases (Craig et al., 2012). Further guidance from the MRC augments the step-like framework of 2000, affirmed the cyclical nature of interventional development, and identified the critical elements involved during interventional development and evaluation (Craig et al., 2012). Therefore, the intervention development first identified the evidence base through a scoping and systematic review. These reviews also established a sound theoretical underpinning to support the mechanisms that the intervention would produce the desired result. The next phase of this thesis was to test procedures through the feasibility study. The purpose of this was to ensure that the intervention is acceptable to participants and compatible with the unerpinning theory. The two-way directional arrows in figure nine emphasise that further development work would be indicated prior to formal evaluation if there are inadequacies in the underlying theory or the intervention is not coherently modelled.

5.5 Results

OPREE is a complex intervention because it contained different interacting components and behaviours (number and difficulty of delivery or receipt), with a complex interaction between SBE and OPREE. Therefore, OPREE comprises several separate, independent and inter-dependent elements with unclear 'active' and 'inactive' ingredients (Medical Research Council,

2000). The 'active ingredient' is a term given to the element that invokes change within an intervention, in this case, face to face sessions that used the various components. The findings from the scoping and systematic reviews, the interviews and focus group indicated that a linear model of cause and effect (*x* intervention caused *y* effect) is often ineffective when the intervention is ill-defined.

5.5.1 Design

The evidence gained from the service evaluation completed prior to the PhD project as well as the evidence from the literature review and interviews completed as part of the PhD have been synthesised into table 12. Data from a total of 99 participants and results from a systematic literature review, interviews and a focus group enabled the modelling of the OPREE intervention and the design of a feasibility study. Table 12 demonstrates that, of 33 SBE programme participants, 13 withdrew before the half way point.

Table 12: Intervention development studies' summary of findings in relation to Medical Research Council guidance categories

MRC Category	Research method / study	Summary of findings
Evidence	Service audit and service evaluation of SBE programme adherence performed by the author before this thesis.	Of 33 respondents, 13 withdrew prior to the halfway point and only 11 completed the full programme
	Qualitative study using 29 patient and 13 practice staff informants (Langer et al., 2014).	Demonstrated that interventions which map the key features of Self-Determination Theory could motivate patients to autonomously exercise by respecting their competence to decide on their needs and priorities, and by forming relationships with them as individuals.
	Study (n = 53) that examined the effects of positively framed compared to negatively framed messages as the mechanisms for promoting activity (Notthoff and Carstensen, 2014a)	Indicated the need to provide positively framed messages rather than those with negatively framed ones.
	Study (n = 277) that examined the effectiveness of the Green Prescription programme in increasing activity and quality of life in community dwelling older people (Kerse et al., 2005).	Indicated the need to provide a combination of strategies that included Motivational Interviewing, exercise specific support, and ongoing feedback.
Theory	Formation of Needs Supportive Communication Strategy based on Self Determination Theory (Ntoumanis et al., 2018)	Highlighted the need to provide a strategy specific to the needs of older people by creating conditions for people to motivate themselves in ways that are rich in choice and personal action.
	Survey of patient respondents (n = 33) who were referred to a strength and balance exercise programme.	Identified that 11 respondents completed the programme and suggested that the facilitators to completion of an exercise programme were the improvement f functional, mental and social health deficits.
	Study that involved patients (n = 12) and health professionals (n = 8) in the acceptability of OPREE's components.	Respondents reported that the preservation of physical, psychological and social health facilitated exercise class attendance. All respondents reported the proposed intervention components as acceptable and potentially useful.

5.5.2 Theoretical paradigm

Following a review of behaviour change models (Chapter two), Self-Determination Theory (SDT) (Deci and Ryan, 2002a) was used as the main psychological theory informing the design and delivery of the intervention. SDT offered a broad theoretically underpinned explanatory framework for particular aspects of human motivation (Vansteenkiste and Ryan, 2013, Ntoumanis, 2012), but lacked an explicit and unequivocal component that would facilitate their improvement.

5.5.3 Motivational Interviewing

Based on the results of the systematic and scoping reviews in Chapters two and three, Motivational Interviewing (MI) was chosen as one of the main components. MI offered a cost-effective (Muller-Riemenschneider et al., 2009), client-centred and goal-oriented style of motivational counselling, that is demonstrably effective across behaviours and in different healthcare contexts (Burke et al., 2003, Hettema et al., 2005, Lundahl et al., 2013b). The style of MI however, lacked an explanatory theoretical framework (Patrick and Williams, 2012), has become confused with different ideas and approaches (Miller and Rollnick, 2009b), incoherent and difficult to define (Hilton et al., 2016, Hilton, June 2017), and has been accused of being *atheoretical* (Draycott and Dabbs, 1998). Contextually though, MI has the aim of enabling personal motivational and physical activity coping strategies (Brodie, 2005), is demonstrably acceptable to older people, and

can have a significant, positive and lasting impact in a relatively short time (Cummings et al., 2009).

While the principles are easy to learn within a short period, and therapeutic effects achieved within limited time constraints (Arkowitz et al., 2008), the style is intricate and is not a panacea (Miller and Rollnick, 2009b, Miller and Mount, 2001). Notably, MI therapists should be adequately trained and receive regular clinical supervision (Sandborgh et al., 2010, Soderlund, 2017) so that the potential for therapeutic infidelity is reduced (Miller and Rollnick, 2014, Soderlund, 2017). Nevertheless, the considerable variation in interventional designs and questionable evaluation indices formed concerns about the applicability of research findings (Song et al., 2014). Recent calls consequently suggest a return to MI's inductive origins which focuses on the quality of delivery versus the effectiveness of provision (Hilton et al., 2016, Hilton, June 2017). Further, while several factors such as illness or family pressures could have caused alterations in perceived autonomy and competence, the rates might have resulted because group exercise instructors seldom employ an active communication style that supports such needs (Hancox et al., 2015).

The reviews, interviews and focus group all identified the need for an intervention that supported and provided useful feedback. Contemporary research has identified the naturalistic approach of Needs Supportive Communication Strategy (NSCS) (Hancox et al., 2017, Ntoumanis et al., 2017, Ntoumanis et al., 2018) as one such component. The strategy aligned

with the components of SDT (Deci and Ryan, 2000, Ntoumanis et al., 2018), maintained OPREE's support of participants' inner belief in their abilities to autonomously and competently exercise (Vansteenkiste and Ryan, 2013), and provided meaningful choices and rationales (Deci and Ryan, 2000).

By supporting an older person's autonomy, competence and relatedness, sustainable SBE adherence could be achieved because the person's exercise is autonomously regulated (Ryan et al., 2008). While the recommendation holds that NHS exercise instructors support autonomy through the provision of NSCS' (Ntoumanis et al., 2018), a similar study used a similar approach and highlighted the challenge of providing SDT and MI during the weekly class based sessions (Miller and Gramzow, 2016). Treatment fidelity was very low, study attrition was high (58% by the final session), and six months after the study, the intervention did not impact on adherence (Miller, 2018; personal communication). Therefore, separate sessions were required, but while telephone or group sessions might offer time efficiency and value, the outcomes might not necessarily be based on valuable *"Shared Decision Making"* by genuinely accounting for the patient's knowledge and preferences, alongside the clinician's expertise (NHS England, Accessed 16th August 2017). Additionally, linked research suggests that telephone consultations do not suit all patients and are not a panacea for meeting demand or reducing costs (Newbould et al., 2017). Findings consequently indicated that separate face to face sessions using MI over a more extended period, perhaps on completion of the exercise

class, could correlate with MI's strategy of planning for the future (Miller and Rose, 2009a). The intervention was therefore delivered on a face to face basis separate to the SBE classes.

5.5.4 Behaviour Regulation

The Behavioural Regulation in Exercise Questionnaire (BREQ) (Mullan and Markland, 1997) was chosen to be part of the OPREE intervention based on patient interviews findings that highlighted the need for a good understanding of how participants' regulated their own exercise. It served as a measure of amotivation, extrinsic, introjected, identified, integrated, and intrinsic exercise behaviour regulations that facilitate or hinder exercise engagement. Initially conceived in 1997, the questionnaire evolved, and version three (BREQ3) is a widely used measure of the behavioural regulation continuum. BREQ3 was developed as a research tool; domains and statements can be found at appendix M. In OPREE, it was recommended to be used in session one as the starting point of discussions towards attitudes to exercise. Consequently, this could then be used to facilitate how participants could achieve future goals (Miller and Rollnick, 1991). The findings also recommended that BREQ3 was administered at the exit from OPREE to help participants and professionals understand their progress.

A Likert scale appraises levels of agreement ("very true for me") or disagreement ("not true for me") with a series of 24 statements relating to particular behaviour regulatory domains. Zero scores represent a respondent's strong disagreement with a given statement. Partial agreements ("somewhat true for me") attract mid-scores of two. Conversely, a score of four denotes firm agreements. As examples, firm identification with the statement, "I don't see why I should bother exercising" would be scored as four; implying amotivation to exercise: deregulation. As another example, firm disagreement with the statement, "I feel guilty when I don't exercise", suggests low levels of introjection. As a multidimensional scale, the summation is calculated by computing the mean scores for each set of items.

A series of three studies have tested BREQ3's psychometric and theoretical properties and found the tool to be valid for assessing exercise behaviour regulation (Wilson et al., 2006). Studies examining exercise behaviours for sports centre attendees (Mullan et al., 1994), exercise referral scheme participants (Markland and Tobin, 2004), adolescents (Sicilia et al., 2014), adult regular exercisers (Duncan et al., 2010), breast cancer survivors (Caperchione et al., 2016), and sarcopenic older adults (Van Roie, 2014) have utilised the tool.

5.5.5 Signposting

The synthesis method used to combine results from the previous Chapters highlighted the successful 'Green Prescription' (Ministry of Health, 2016), which included motivational interviewing alongside signposting and continued supportive techniques (Ministry of Health, 2016). The White Paper "Our Health Our Care Our Say" (Department of Health, 2006) first highlighted signposting as a method for promoting health, independence and access to local and holistic services. Chapter one, the introduction to this thesis, discussed preliminary work that first highlighted the logical and intuitive concept of signposting. Signposting was included as a component of OPREE because interview respondents said that they needed more information about local services. A study where participants perceived signposting to be acceptable and supportive in the improvement of their chronic obstructive pulmonary disease self-management strategies (Langer et al., 2014) reinforced these suggestions. The approach supports autonomy, relatedness, and competence (Hagger and Chatzisarantis, 2005), and was shown to enhance motivation by signposting to alternative physical activities (Flannery et al., 2014).

Of note, increasing evidence suggests that this strategy may reduce the demand placed on NHS services (King's Fund, 2017b). The National Institute for Health and Care Excellence "Mental well-being and independence for older people" (National Insititute for Clinical Excellence, 2016), the NHS Five Year Forward View (NHS England, 2014), the GP Forward View (NHS England, 2016), and the local Sustainability and

Transformation Programme (Pearson, 2016a) all advocate appropriate signposting. Practical, and perceptibly acceptable, signposting has been used and demonstrated to successfully engage socially isolated older adults with social networks, which afford a range of psychosocial and physical health benefits (Greaves, 2006).

5.5.6 Education, information giving, and support

The scoping and systematic literature review identified the effectiveness of comprehensive packages that support participants through education and information giving (Kerse et al., 2005, Elley et al., 2003, Gothe et al., 2015b, Harada et al., 2010), it was therefore included in the OPREE intervention. As one example, researchers emphasised the need to identify, prioritise, and support psychosocial and clinical needs so that a highly acceptable and perceptually useful intervention which addressed psychosocial needs could be provided (Langer et al., 2014). The researchers offered self-help materials and appropriately signposted patients to third sector services. OPREE did not include self-help leaflets and information sheets because the SDT recognised that people are more likely to use information if they have sourced it themselves; they were, however, signposted appropriately; participants then updated the outcome during the next session. Hence, OPREE included an element of information giving and direction to information. Importantly, while designed for older people, such information giving, education and support aimed to improve adherence to

the SBE classes. The OPREE intervention offered information that focussed on managing a particular health condition where it limited the participant's ability to engage with exercises. Equally, information giving clarified the reason for a given class exercise because the misunderstanding impaired perceived exercise autonomy and competence.

5.5.8 Intervention description

The literature identified the need for an age-appropriate approach (French et al., 2014a) that enhanced the capability to cope with acute (Watkins et al., 2007) or chronic physical or mental health conditions (Sallis et al., 2015, DeMaria, 2012). However, the literature also identified that self-regulatory or planning principles might be less effective because many older people find them either more cognitively demanding or less acceptable (French et al., 2014a). Importantly, preceding Chapters identified the need to support participants' age-related challenges (Dishman and Ickes, 1981) and reflect their variable exercise engagement (French et al., 2014a), changing situational needs, goals, and support networks (Stewart, 2009, Oliver et al., 2016, Deci and Ryan, 2000). It could not, however, represent a superficial symbol that suggested OPREE as intellectually credible (Fyffe, 2017). Therefore, OPREE needed a strategy that facilitated the identification and support of exercise for individualised and pleasurable or inspiring purposes (Biddle and Mutrie, 2008).

5.5.8.1 Baseline appraisal

The OPREE baseline appraisal, completed through interview and completion of the BREQ3, was planned to occur as close to the participant's commencement of the strength and balance exercise as possible.

5.5.8.2 When is the best time to deliver OPREE?

During OPREE's formation, the optimal approach and dosage required consideration. Both the background literature review and the systematic review suggested that OPREE needed to be ongoing with the use of interventions that mapped the critical features of interventions described by SDT because they had enduring motivational benefits. These interventions were considered to motivate participants to self-manage their long-term conditions by respecting their competence to decide on their needs and priorities, by forming relationships with them as individuals rather than patients, and by fostering a sense of autonomy (Langer et al., 2014).

Langer and colleagues (Langer et al., 2014) found four home sessions to be acceptable, but Arkkukangas and colleagues (Arkkukangas et al., 2015) found five sessions delivered over three months to be insufficient. Nonetheless, a review of nine studies (n = 3,264 participants) demonstrated an average dosage of 4.5 (30 to 60 minutes) sessions which targeted up to two behaviours over five months, to significantly improve physical activity for adults with type II Diabetes (Soderlund, 2017). The

four processes of motivational interviewing are engaging, focusing, evoking, and planning (Miller and Rollnick, 1991). Reflecting the resources and time limitations of this Doctoral thesis and MI's guidance, OPREE was planned to be delivered over four sessions; each lasted approximately one hour.

1. Session one, it was planned that the therapist would engage the participant in initial discussions complete the BREQ3, review their situation regarding their future goals, plan how they could achieve them and how they could implement their plan.
2. In session two the therapist and participant would set the direction of travel together.
3. Session three was designed to evoke the motivation to change.
4. Session four sought to prepare the participant for sustained exercise class adherence.

The literature reviews found evidence that engagement interventions needed to be alongside the exercise class (Room et al., 2017). Thus, it was recommended that the first OPREE intervention session should occur within two weeks of commencing the SBE programme. All sessions should last between 30 and 60 minutes. To increase engagement with OPREE, it was recommended that a mutually agreed date and time for the following meetings (four weekly) on completion of each session was arranged. There was no evidence from the literature or interviews about whether the

presence of family members was beneficial. Therefore no recommendations can be made at this time.

5.5.8.3 Who is the best person to deliver OPREE?

Langer and colleagues (Langer et al., 2014), provided an intervention which was included in the literature reviews as part of this thesis, and ensured adequate contextual training. The researchers recommended that those with appropriate contextualised healthcare training provide similar interventions. Therefore, to ensure a targeted, flexible and responsive intervention, a healthcare professional trained in assessment and treatment progression, SBEs, SDT and MI should deliver OPREE; this will most likely be an experienced physiotherapist. As an example, a participant might be motivated to exercise but struggles to do so because of a given condition. To enable interventional adjustments according to the person's needs, knowledge of the intervention alongside the given health disorders is essential. The evidence from the literature reviews and interviews recommends that to provide MI then training is essential. The aims of a suitable course should be to:

- Define and describe Motivational Interviewing and 'The Stages of Change'.
- Understand MI's sequence.

- Understand the five principles of Motivational Interviewing: expressing empathy, developing discrepancy, avoiding arguing, rolling with resistance and supporting self-efficacy.
- Understand 'The Stages of Change'.
- Understand the traps to avoid in early stages of therapy.
- Understand how to move from stage one to two.
- Understand how to move from stage two to three.
- Understand different types of resistance: arguing, interrupting, denying and ignoring.
- Understand how to move from stage three to four.
- Understand recapitulation: summarising how the client sees the problem and their ambivalence, reviewing the evidence about risks and challenges.
- Understand the maintenance phase.

The delivery of MI is not easy to learn (Miller and Rollnick, 2009b). Consequently, it is recommended that anyone providing MI is mentored (Hilton et al., 2016) so that providers are experienced and familiar with the programme (Arkkukangas, 2017).

5.5.8.4 Where is the best place to deliver OPREE?

The scoping and systematic reviews highlighted several potential methods of intervention delivery. Murphy and colleagues (Murphy et al., 2008)

provided group sessions, but the SBE programme provided these and work highlighted the difficulties associated with supporting older peoples' needs during an exercise class (Miller and Gramzow, 2016). Harada and colleagues (Harada et al., 2010) delivered "Telerehabilitation' which offered remote monitoring with the Health Buddy system. Initial adherence was high but waned because it was inflexible and participants became bored. Several included studies highlighted face to face contact (Langer et al., 2014, Iliffe et al., 2014, Schneider et al., 2004, Kerse et al., 2005), and interview respondents advocated home visits. The systematic review specifically identified home visits (Iliffe et al., 2014, Langer et al., 2014, Murphy et al., 2008), arguably because they are pragmatic, naturalistic, and increasingly common NHS practice. The NHS Five Year Forward View (NHS England, 2014) advocates such home visits; provided by many health and social care services. Qualitative interviews within four included studies (Murphy et al., 2008, Iliffe et al., 2014, Kerse et al., 2005, Langer et al., 2014) also demonstrated their acceptability.

5.6 Discussion

OPREE was explicitly developed to help older people engage in SBE classes in Nottingham. It was formed through qualitative and quantitative data sources and synthesised with a modelling approach based on the MRC guidelines for developing complex interventions (Medical Research Council, 2008). Aggregate representative data through surveys and interviews with

99 participants and reviews of published evidence enabled its formation. It has a duration and skill level that could be feasibly provided in the NHS by existing staff and could be adapted locally for any older persons' group exercise.

The main components were underpinned by SDT and included behaviour regulation, NSCS, MI, signposting, information, education and support. In the context of increasing older people's rehabilitative exercise engagement, and to the best of knowledge, no published study has utilised OPREE's intertwining components.

5.6.1 Strengths and limitations

OPREE's key strength is that both clinical practice and academic research have enabled its formation, by including data from clinicians and patient plus published evidence from other studies. The primary limitation is that OPREE is not, generalisable in its present form, to other populations other than older people engaged in SBEs. However, a strength was that it was developed using a published and recognised framework for intervention developments.

While the MRC's framework for the development of complex interventions served as a guide, there was little guidance on how to progress through the early phases of the framework, and concise information was not provided about how to synthesise information from different sources. This limitation is highlighted by the knowledge that many such interventions are formed

from a number of components that often act both independently and interdependently (Campbell et al., 2007).

5.6.2 How OPREE fits with the existing literature

The development and reporting of complex behaviour change interventions is challenging, but necessary, if a firm scientific basis for achieving truly theory-based rather than theory inspired intervention is to be achieved (Michie et al., 2008). OPREE primarily combined both SDT (Deci and Ryan, 2002b) and the clinical style of MI (Rollnick et al., 2004). Both strategies drew on the Rogerian principles of patient-centeredness with unconditional regard (Rogers, 1961) and their mutual assumption of an innate tendency for personal growth toward psychological integration (Friederichs et al., 2016) means that both paradigmatically overlap. By offering a coherent theoretical framework for understanding MI's processes and efficacy (Markland et al., 2005), SDT offered the theoretical backing that MI lacked (Patrick and Williams, 2012, Miller and Rose, 2009a). Equally, MI provided SDT with the detailed clinical direction (Livingstone and Gaffney, 2016b, Patrick and Williams, 2012) so the involved psychological processes are better understood (Markland et al., 2005, Livingstone and Gaffney, 2016b, Hilton et al., 2016).

While MI generates a more autonomy-supportive environment, the intervention also contained elements of creating a structured environment (Silva et al., 2008) such as the arrangement of intervention content into

sessions, addressing personal barriers or monitoring physical activity (Hancox et al., 2017). While this approach might seem obvious to any healthcare provider, evidence proposes that such interactions often do not map SDT (Reeve et al., 2004, Reeve and Jang, 2006, Hancox et al., 2017, Ntoumanis et al., 2018). Furthermore, only 23% of physiotherapists usually deliver a brief intervention and 34% appropriately signpost to other forms of support (Lowe et al., 2017). Notably, one SDT-grounded intervention used diabetes care as its platform and drew MI's sessional guidelines and strategies (listening, reflecting, handling resistance, and supporting autonomy) prevalent within motivational interviewing (Kirk et al., 2007). These data reinforced the need for a method that promoted the use of both approaches. Notably, while Motivational Interviewing and Trans-Theoretical Model usually sit side by side, the model was not utilised within OPREE because it offers an understanding of participants' stage of behaviour change. Of more relevance within this thesis was an understanding of behaviour regulations. BREQ3 offered such an understanding to a greater extent.

Chapter six details the feasibility study that assessed the practicality of delivering OPREE.

Chapter Six: The OPREE Feasibility study

6.1 Summary

This Chapter builds on previous work and details the findings from a mixed methods feasibility study. The Chapter commences with an overview of aims, objectives, and the methods used. The Chapter then forms four further sections. First, the recruitment and exercise class attendance are detailed. Next, the results from the outcome measures are presented, then a process evaluation that includes an outline of the acceptability of the intervention follows. This section precedes the discussion and formation of conclusions before the Chapter forms conclusions.

6.2 Introduction

Data from literature reviews, interviews, and focus groups were used to develop OPREE as an intervention. OPREE was specifically targeted at patients attending Strength and Balance Exercise (SBE) classes; routinely provided by the NHS. This feasibility study was completed to estimate important parameters that are needed to design the main study. By nature this study did not seek to establish the effectiveness of OPREE, it explored and detailed the characteristics and suitability of proposed outcome

measures and feasibility of delivering the intervention in the 'real world' (Arain et al., 2010, National Institute for Health Research, Accessed 28th January 2018).

6.3 Study aim

To assess the feasibility, acceptability, tolerability, and efficacy of OPREE as an additional intervention designed for the promotion of attendance to a programme of strength and balance exercises.

6.4 Study objectives

1. To explore how OPREE influenced attendance at a strength and balance exercise programme delivered by the NHS.
2. To examine whether OPREE was acceptable to participants through exit interviews.
3. To analyse influential factors that affected exercise engagement through outcome measures.
4. To assess the practicality and acceptability of a future, more extensive study.

6.5 Approvals, authorities and sponsorships

The Integrated Research Application System (Reference: 171548) enabled the requests for relevant authorisations. The University of Nottingham acted as a sponsor (Reference: 15117) and provided Liability insurance. Research Ethics Committee (East Midlands Nottingham 1) gave ethical approval: 16/EM/0027. A subsequent substantial amendment was requested to change two questionnaires and to gather electronic data at the six-month point rather than four months. East Midlands Nottingham 1 Research Ethics Committee approved the amendment application on 17th June 2016. Nottinghamshire Healthcare NHS Trust provided NHS Research and Development support, and this was re-asserted following the substantial amendment on 18th June 2016. Full REC and NHS Research and Development approvals are available at Appendix D, and were received before approaching any participant.

6.6 Method

This unblinded, non-randomised, single-site feasibility study comprised a four-month intervention phase, followed by a two-month observational period. Additionally, an embedded qualitative component enabled interviews with participants after completion of the intervention phase. A community strength and balance exercise (SBE) programme delivered by

the NHS served as the platform that enabled delivery of the OPREE intervention. Two groups allowed data sampling. Participants who had been referred to the programme, and additionally received the OPREE intervention formed the first cohort. Furthermore, a contemporaneous group of patients who only attended the exercise programme formed a controlled sample and enabled the comparison. The collected outcome data was used to assess the feasibility of the trial parameters and the influential factors that future studies need to address. Attendance at the SBE programme formed the primary outcome measure. Additionally, several possible factors which may have influenced attendance were explored. A process evaluation examined participant recruitment, acquisition of the evaluation data, and the intervention's implementation. Descriptive statistics summarised the outcomes. The qualitative analysis examined participants' perceptions of OPREE after the intervention, and used framework analysis; a hierarchical, matrix-based method developed for applied research which allowed focused interrogation of data in a relatively short space of time (Ritchie and Spencer, 1994).

6.6.1 Participant recruitment

Participants were recruited from the SBE classes. A target of 12 participants to represent a standard SBE class size was proposed. Figure 10 illustrates how participants flowed through the study. On receipt of all necessary

permissions, recruitment commenced on 21st September 2016 and finished on 16th December 2016.

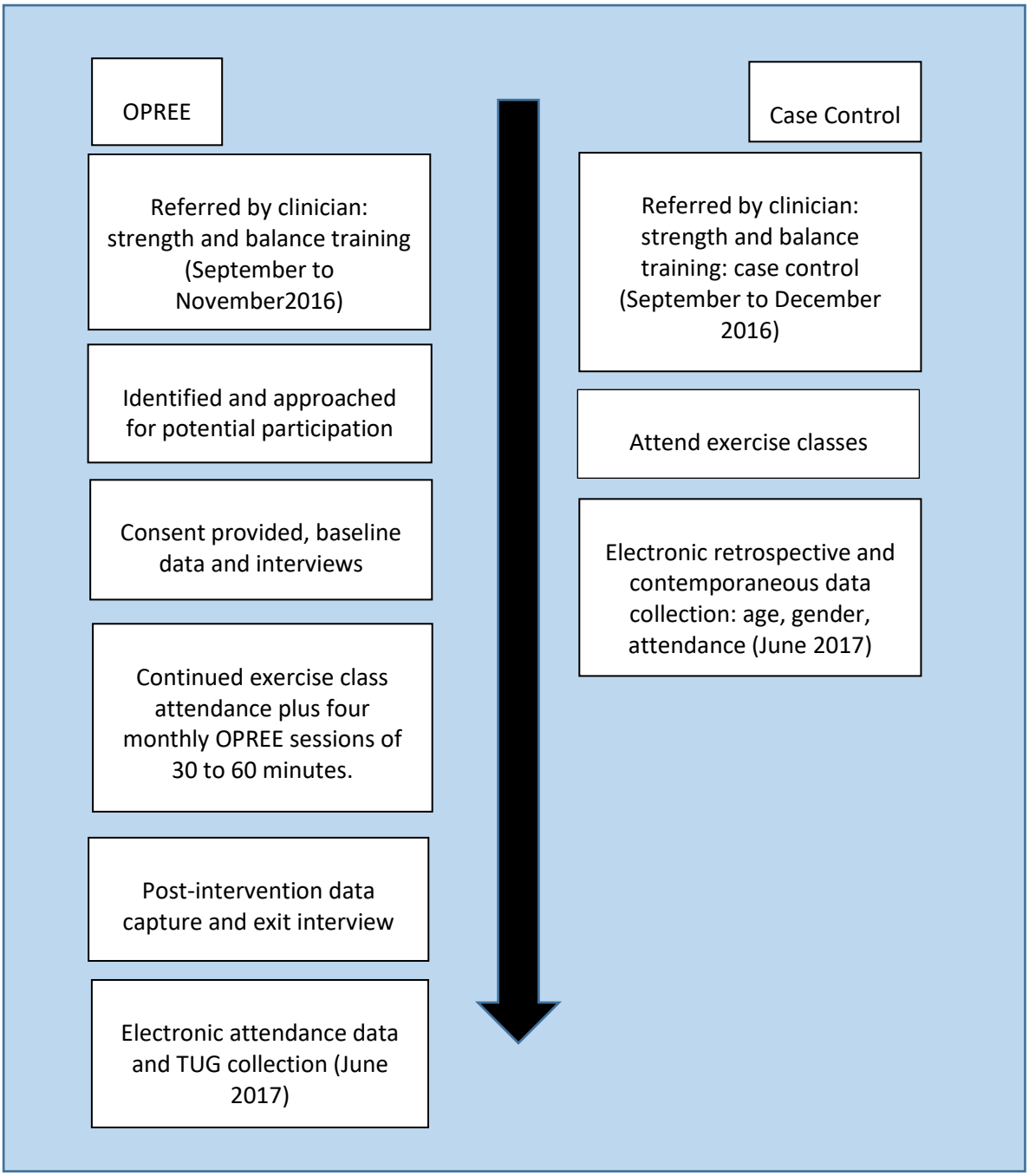


Figure 10: Flow of participants

Participant involvement ceased on 27th April 2017, but remote data collection occurred in June 2017. Clinicians who were members of the patient's clinical team prospectively recruited participants. A NHS database search for all SBE programme referrals from 1st September 2016 to 31st December 2016 took place in June 2017; this enabled the formation of the control sample.

Chapter five detailed the strength and balance exercise (SBE) programme's eligibility criteria. Briefly, eligible patients were community-dwelling, had suffered at least one fall within the preceding 12 months, could perform the Timed Up and Go Test in less than 40 seconds, and could march on the spot for one minute and score ≤14 on the Borg Rate of Perceived Exertion scale (Borg, 1982). Additionally, the only study inclusion criterion was an invitation to attend the exercise programme. Study exclusion criteria were the inability to consent to study participation or to speak English (and therefore unable to participate in an interview fully).

The clinician referring to the programme made the first approach to the patient. At the initial contact and with the use of the Participant Information Sheet (Appendix F), the clinician briefly discussed the study with the potential participant. If the patient agreed, KA made telephone contact to arrange for the full consent to be taken, interview and collection of baseline data and completion of an interview. The Participant Information Sheet guided discussions when obtaining informed consent. During this process, KA explained the voluntary nature of entry into the study, that treatment

and care would be unaffected, and that participants could withdraw at any time, but attempts would aim to avoid this occurrence. Participants were advised that data collected to that point, could not be erased and could be used in the final data analyses, in the event of such withdrawal.

6.6.2 Outcome measures

Attendance at the SBE programme formed the primary outcome measure because the overarching aim of OPREE was to help older people stay engaged with their prescribed exercise programme. Electronically collected attendance data were collected through monitoring of the NHS database throughout the interventional period. A final collection was made in late June 2017; the latest possible programme completion date. If the results indicated that the intervention had improved engagement, a planned consultation with a group of therapists would, by consensus, specify whether the change constituted a clinically significant difference.

Secondary data explored the feasibility of other outcome measures for a future trial and examined whether the OPREE intervention had any impact on different domains. The secondary outcome measures are listed below and then described in more detail. Examples of these questionnaires are available at Appendix H.

1. Behaviour Regulation Exercise Questionnaire (Version 3): a measure of exercise behaviour regulation – amotivation, external, introjected, identified, integrated and intrinsic.
2. 12-Item Short Form survey (SF12): a measure of perceived quality of life.
3. Nottingham Extended ADL Scale (NEADLS): a measure of everyday functional ability in activities.
4. Timed Up and Go: a test of functional mobility.

KA completed the questionnaires with the participants during the participants' baseline interview before the intervention started, and again within two weeks of the final OPREE intervention.

6.6.2.1 Behaviour Regulation Exercise Questionnaire (Version 3)

Chapter five (page 167) provided details of the Behaviour Regulation Exercise Questionnaire (Version 3) (BREQ3) but briefly, through a series of 24 questions, the survey measured amotivation (deregulated exercise behaviour), extrinsic (exercising for some form of reward), introjected (exercising because of a sense of obligation), identified (exercise for a specific purpose), integrated (exercising for the benefit), and intrinsic (exercising for the benefits and values) exercise behaviour regulations.

Respondents were requested to indicate their level of identification with a given statement. A zero score showed no association with the particular statement. Conversely, a score of four showed a reliable connection with the statement.

6.6.2.2 12-item Short Form survey

The 12-item Short Form Survey (SF12) forms a brief but comprehensive psychometrically sound survey (Maruish, 2012) that captures relevant health statuses at different time points. Although the tool does not measure attendance, it is often used in economic evaluations as a quality of life measure. A study compared the EQ-5D with the SF12 (Johnson and Coons, 1998). Both surveys were valid, but SF12 was more sensitive to differences associated with those less severe conditions such as those seen within community set exercise classes. Although criticised because of less accurate scores (Cuesta-Vargas et al., 2013), an equivalent study (n = 185; mean age 86 ± 6.1 years; 82% female) demonstrated construct validity (Resnick and Nahm, 2001). Finally, a further study involving a Canadian minority population (n = 1,171) reported SF12 physical and mental component summary scores to be a valid instrument for measuring health status in minority populations (Fisher and Newbold, 2014). Normative data values utilised within the software (QualityMetric Health Outcomes™ version 5.1)

(Maruish, 2012) were formed by examining the health statuses of a comparable, quota sample (n = 2,760) (Mols et al., 2009).

Retrospective student licence agreement was sought and provided for this study: Agreement QM041584 - OPTUM #CT189824 OP064368 (Assignment letter available in Appendix K). QualityMetric Health Outcomes ™ Scoring Software version 5.1 enabled data handling and computation (Maruish, 2012). KA administered the surveys on paper, entered responses into the scoring software, and checked data for accuracy and assurance that all replies were within range. The 12 questions on the SF12 yielded an eight-scale profile of functional health and well-being where higher scores indicated a better health state:

1. Physical functioning (PF),
2. Role physical (RP),
3. General health (GH),
4. Bodily pain (BP),
5. Vitality (VT),
6. Social functioning (SF),
7. Role emotional (RE),
8. Mental health (MH).

This thesis utilised SF12 version II as a concise and clinically relevant secondary measure of significant health-related changes, because it

enabled a more substantial understanding of factors affecting exercise engagement factors at different time points.

6.6.2.3 Nottingham Extended Activities of Daily Living Scale

Nottingham Extended Activities of Daily Living Scale (NEADLS) was developed (Nouri and Lincoln, 1987) and validated (Gladman et al., 1993) in the context of stroke survivors, where the questionnaire was found to enable the monitoring of therapeutic progress. The survey incorporated four sections:

- Mobility: for example, walking outside, climbing stairs, getting in and out of the car.
- Kitchen: for example, managing to feed yourself, independently making a hot drink.
- Domestic: for instance, doing the washing up, independently shopping.
- Leisure: such as writing letters or going out socially.

The scale recorded and ranked actual activities performed in the preceding weeks and according to the frequency ("not at all"), and independence of abilities ("with help", "on your own with difficulty", "on your own"). Zero scores were indicative of an absence of activity performance or doing it with help. A score of one indicated the ability to act either with difficulty or

independently. Thus, a potential score of 22 showed a high level of capabilities and independence.

In the context of hip replacement surgery (n = 81), a comparison of SF-36, London Handicap Scale and NEADLS questionnaires (Harwood and Ebrahim, 2000) found the latter easier to administer. NEADLS was, however, also poorly responsive to change. In the context of stroke rehabilitation (n = 70) though, Wu and colleagues found the NEADLS to be more responsive than the Frenchay Activities Index questionnaires (Wu et al., 2011a, Wu et al., 2011b). Secondary analysis also established that a change score of ≥ 4.9 points indicated a change in functional abilities and that a mean change score of ≥ 6.1 points indicated a clinically significant outcome.

This study utilised NEADLS because it enabled the investigation of functional differences that might have influenced exercise engagement. Further, the short and quick survey reduced the burden of participant assessment.

6.6.2.4 Timed Up and Go

The Up and Go Test was conceived in 1986 (Mathias et al., 1986) and then the timed element, incorporated in 1991 (Podsiadlo and Richardson, 1991). The Timed Up and Go (TUG) quantified the ability of patients to perform successive locomotor tasks where a person stands up from a firm upright chair, walks 3 metres, turn around, walks back to the chair, and sits down

again. The test is quick, requires no specialised equipment or training, and is commonly integrated into clinical practice.

Retest reliability and interrater reliability of the TUG measurements have been demonstrated to be high and reflected changes in functional performance in the presence of frailty (Richardson, 1991, Podsiadlo and Richardson, 1991) and conditions such as Parkinson's Disease (Morris et al., 2001). More recently, a secondary data analysis from a multicentre RCT which provided a 12-week exercise programme for heart failure patients (n = 278, mean age = 62 years) demonstrated excellent test-retest reliability (Hwang et al., 2016). Acknowledging a potential ceiling effect, however, Schoene and colleagues (Schoene et al., 2013) suggested that TUG might be of more value in those who are less healthy with a lower functional ability. Finally, one study (n = 114, mean age = 86.7) found that sedentary behaviours were associated with TUG scores and falls-related self-efficacy (Leung et al., 2017). The test remained highly relevant to this thesis' aims, was frequently used as a clinical measure of treatment efficacy, and importantly, was routinely used within the SBE programme.

For these reasons and because it served as an objective measure of functional capacity and improvements as the result of exercise engagement, this thesis utilised TUG. At the time of this study, NHS staff were completing the tool during the screening process for the strength and balance exercise programme. Thus, to prevent participants having to

perform it twice and to also explore the potential use of existing data sets for a future trial, it was decided to use the NHS data as research data.

6.6.7 Missing data

A methodological survey of leading general medical journals found that 87% of published trials reported missing participant data, and 30% lost statistical significance when making plausible assumptions about the outcomes (Akl et al., 2012). Equally, when reported, information is not consistent and transparent. Therefore, loss to follow-up data reporting included the timing and reason for withdrawal and baseline characteristics, alongside a description of the potential implications for future studies (Akl et al., 2015).

6.6.8 Data analysis of outcome measures

The primary outcome measure of attendances at the SBE classes was analysed by splitting the data into two groups:

1. Participants who received the OPREE intervention in addition to SBE (intervention group)
2. Participants who only received SBE (case controlled group).

SPSS (version 22) enabled quantitative analysis of attendance rates and BREQ3. Data from SF12, NEADLS and TUG were not examined with SPSS. This small feasibility study indicated that statistical significance testing was inappropriate because of a limited ability to detect minor changes (Hicks, 2009, Agresti and Finlay, 2014), and reduced accuracy of statistical significance (Kirkwood and Sterne, 2003, Agresti and Finlay, 2014). Consequently, descriptive data measured trends toward the efficacy of the intervention of increasing the exercise programme attendance. The future trial will in turn measure effectiveness.

6.6.9 Effect sizes

Several methods of interpreting effect sizes have developed. This thesis adapted Cohen's *d* conventions that used the standardised mean difference with the use of the mean and standard deviation to describe changes as small (≥0.20), moderate (≥0.30), and large (≥ 0.50) (Newcombe, 2013). Cohen (Cohen, 1977) described *Cohen's d*, where an effect size of 0.2 is termed 'small', 0.5 as 'medium', and 0.8 as 'large'. While critics argue that to use uses the terms 'small', 'medium' and 'large' out of context is dangerous (Glass et al., 1981), Effect Sizes (ES) quantify the difference between two groups in a simple way that has many advantages over the use of tests of statistical significance alone. ES emphasises the magnitude of the change rather than confounding this with sample size. Equally, the measure served as a useful quantification of OPREE's efficacy, and allowed

movement beyond a dichotomous 'Does OPREE work or not?'. Rather, the method allowed the question 'How well does OPREE work?'. The ES is calculated by subtracting the two outcome means and dividing by the pooled standard deviation. ES might demonstrate a change after an intervention. They do not however, provide an understanding about how a given intervention might work, or which components are required for which outcome (Moore et al., 2015). This thesis accepted *Cohen's d* convention because it only measured the difference; other sections explored the context.

6.6.10 Age in relation to attendance

Age was additionally investigated as a correlate with attendance because the scoping review (Dishman and Ickes, 1981), preliminary data analysis, and interview data all suggested the need to target OPREE according to age.

6.6.11 Process evaluation

In the understanding of the underpinning causal assumptions, a process evaluation of an intervention is vital. Such assumptions are frequently drawn from theory but sometimes informed by factors such as past experiences or common sense. Thus, an evaluation aids the understanding of how interventions work in practice and the building of an evidence base

that informs policy and practice (Moore et al., 2015). Many feasibility or pilot studies fail to test procedures for the intervention's acceptability (Craig et al., 2008), the quality of execution of the complex intervention, success rate of recruitment and quality of the study population, and the process of data acquisition. Equally, many randomised controlled trials focus on outcomes, not on the processes involved in implementing an intervention. Figure 11 is adapted from the Medical Research Council guidance for process evaluations of complex interventions, and illustrates the essential functions and relationships (Moore et al., 2015). Given the mandate for this study to evaluate the potential for future studies into OPREE, a process evaluation helped to distinguish between inherently faulty, poorly delivered, or successful interventions (Oakley et al., 2006).

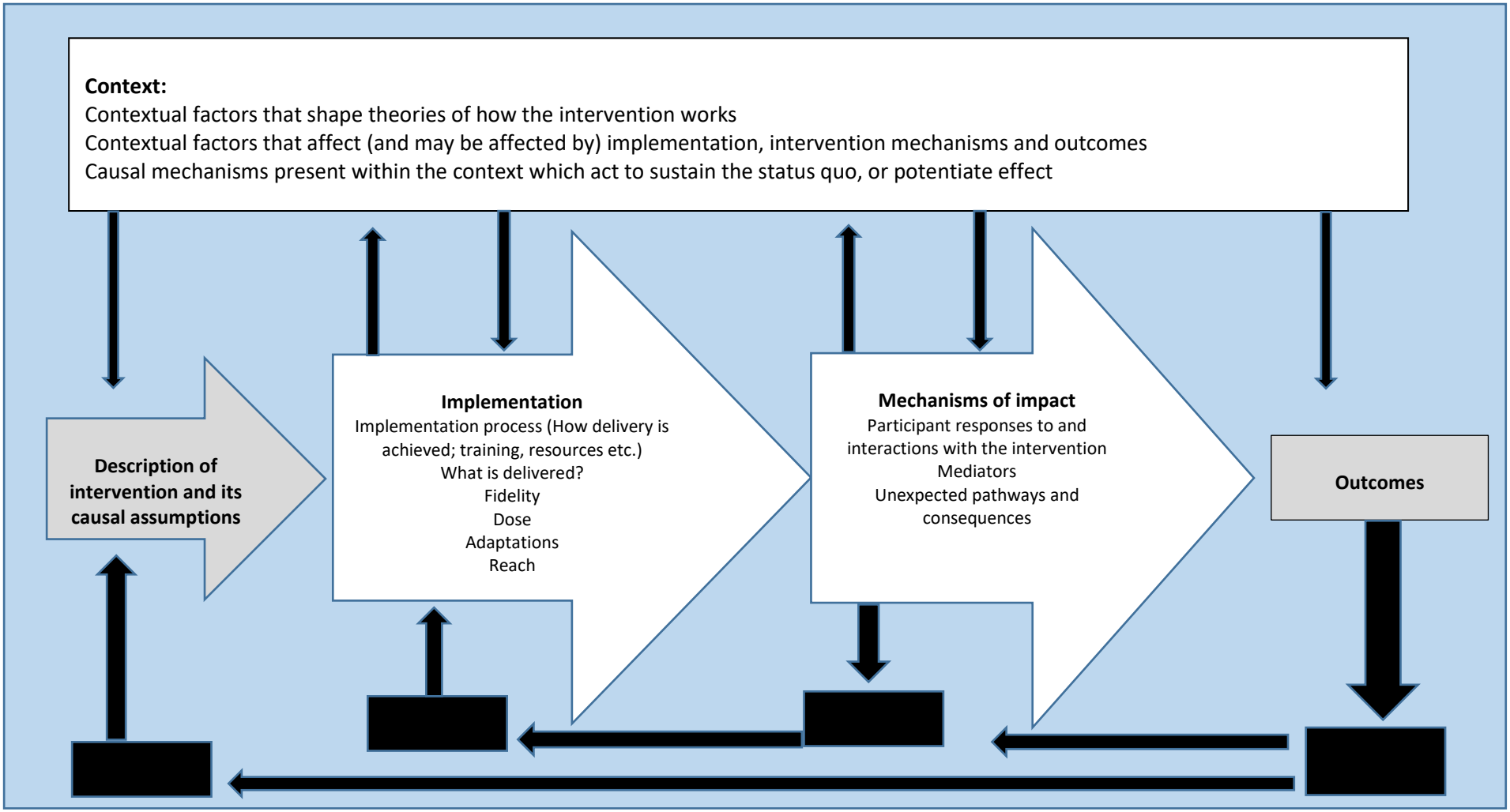


Figure 11: MRC framework functions and relationships

To understand meaning is therefore critical in interpreting the findings of a specific assessment and generalising beyond it and causal assumptions about implementation, impact and outcomes need to be described (Moore et al., 2015). Reelick and colleagues advocated descriptions of the success rate of recruitment and quality of the study population, the quality of execution, and the process of acquisition of the evaluation data (Reelick et al., 2011). The adapted diagram illustrated the critical functions of a process evaluation as the context, the implementation, and the mechanisms of impact (Moore et al., 2015).

6.6.11.1 Assessing OPREE's feasibility and fidelity

Two measures formed the process evaluation and assessed the fidelity of OPREE's delivery: an exit interview and the Motivational Interviewing Treatment Integrity (MITI) tool (Moyers et al., 2016). The outcomes collected to evaluate the feasibility of the trial parameters were: the study population recruitment, quality and retention, completion of health outcomes, missing data, delivery of the intervention, and participants' views of the intervention. Additionally adverse events that might impact on adherence to the exercise programme (such as a fall or joint pain) were collected through review of the records and verbal disclosure by the participant.

Before being tested, innovative interventions are not always fully developed which results in the challenging maintenance of intervention fidelity. As an example, recruitment was problematic in one trial where few study referrals were initiated (Stevens et al., 2013). Feasibility studies can help to gain an understanding of appropriate recruitment strategies and the necessary resources needed for recruitment in a definitive trial. Therefore, KA recorded the times taken to perform recruitment, taking consent, conducting assessments and the intervention sessions themselves.

6.6.11.2 Motivational Interviewing Treatment Integrity

As an empirically-supported intervention, a wide variety of settings use Motivational Interviewing (MI), but many clinical trial results that used this method have reported varied ES (Moyers et al., 2016). This lack of uniformity has led to concerns about the integrity in the delivery of this complex intervention (Livingstone and Gaffney, 2016a) and some trials with MI demonstrate incompatible peripheral elements, for example, providing instructions or mandatory treatment plans (Miller and Rollnick, 2014). The Motivational Interviewing Treatment Integrity (MITI) tool has been cited in the scientific literature more than 260 times (Moyers et al., 2016). The instrument has also been independently found to be reliable (Pierson et al., 2007), valid (Forsberg et al., 2008), and served as a measure of integrity,

but also to review and incrementally improve KA's MI proficiency (Moyers et al., 2005). MITI holds several domains and table 13 details these.

The scoring sheet and full instructions are in Appendix L. MITI appraised the so-called 'spirit' with the 'global scores', and the 'technical' components with the 'behaviour counts'. The 'spirit' of MI captured the 'gestalt', the counsellor's attitude, genuine interest, and ability to empathise with the client.

The 'technical' ability required the use of evocation, elicitation, and reinforcement of change talk techniques. The combination of closed and open questions with reflections represented this technical ability (Miller and Rose, 2009b). The basic underlying assumption of MI and Trans Theoretical Model is that people are of one mind with component functions such as thoughts, instincts or executive functions. Consequently, the multiplicity of factors influencing exercise engagement (Livingstone and Gaffney, 2016a) was increasingly acknowledged.

The **global** counsellor rating score represented the whole session and covered evocation, collaboration, autonomy/support, direction, and empathy (Moyers et al., 2016): the 'gestalt'. **Behaviour** counts reflected giving information, MI adherent responses, MI non-adherent responses, question, and reflection frequency.

Table 133: MITI domains and characteristics

Domain	Characteristics
Evocation	Maintenance of conversation in the specific direction of a particular change goal. Therapists who work proactively to evoke the client's personal reasons for change and ideas about how change should happen, have a high level of evocation.
Cultivating talk	Therapists who, throughout the session, actively encourage and support change language with the confidence to execute that change in favour of the goal, achieve higher ratings on the cultivating change talk scale.
Collaboration	Therapists who actively foster and encourage power-sharing in such a way that client substantially contributes and influence the session score highly in the collaboration domain. Where permission is assigned, for example where the client asks directly for a professional opinion, this is categorised as collaboration.
Empathy	Therapists who demonstrate evidence of a thorough understanding of the client's point of view and its implicit meaning score highly in the empathy domain.
Giving information	Without persuasion or warning, the therapist gives information, educates, or expresses a professional opinion in a neutral tone. The spirit of MI tries to avoid this.
Non-adherent behaviour	Were the therapist to attempt persuasion without permission, this would be classified as non-adherent behaviour. There are only two MI non-adherent behaviours: persuade and confront.
Simple reflections	These convey an understanding or facilitate exchanges, but add little or no emphasis to the meaning of what was said. They may mark significant or intense emotions, but do not extend the client's original statement. For example, the therapist might summarise several statements as a simple reflection.
Complex reflections	These add substantial meaning or emphasis to what was said and convey a deeper or more complex picture. For example, the therapist might emphasise a particular section of the dialogue to make a point, or to redirect the conversation.

The assigned score captures the clinician's ability to 'cultivate change', use 'softening sustain talk', work in partnership, and empathise. The full appraisal results from the **global** scores together with the **behaviour** counts. Empathy and MI non-adherent behaviours represent reliable treatment predictors and therefore are checked by examining whether it

crossed the global counsellor thresholds and by calculating the amount of MI non-adherent responses.

An MI trained and experienced peer physiotherapist agreed to act as an independent reviewer and used MITI in the performance of a 25% review of sessions (n = 9). Recordings were selected at random which was designed to be representative while eliminating sampling bias. The reviewer utilised the scoring sheet while listening to the recording.

6.6.12 Data analysis of the MITI

The MITI scoring sheet enabled analysis the use of MI during interviews. The scoring sheet is available at Appendix K.

6.6.13 Interviews

Semi-structured face to face interviews enabled analysis of influential factors that affected exercise engagement before and after OPREE as an intervention. They aimed to explore any impact that OPREE might have on these factors and how it influenced attendance to the strength and balance exercise programme. The exit interview purposefully examined the acceptability and usefulness of OPREE.

Increasingly, healthcare researchers are widely acknowledging the value of face to face interviews. In-depth interviews widely occur in naturalistic

settings which facilitate non-generalizable (King and Horrocks, 2010), potentially sensitive discussions (Sofaer, 2002) that capture individual perspectives, values, attitudes and beliefs (Ziebland and McPherson, 2006). As a qualitative form of inquiry, cues such as voice, intonation, or body language supplements the immediate and spontaneous verbal answer (Opdenakker, 2006). In capturing those factors that influence older peoples' exercise engagement, face to face interviews were judged as more effective than a telephone interview.

6.6.14 Data analysis of interviews - Framework Analysis

Chapter four detailed Framework Analysis (FA), but briefly, the method was developed for large-scale social science research (Ritchie and Spencer, 1994) and sat within the family of methods termed thematic analysis, which categorise those commonalities and differences in qualitative data (Ritchie and Lewis, 2003). As such, FA represented a data management tool (Spencer, L, 2017; personal communication). Figure 8 in Chapter four details the data journey. There were five stages: transcription, familiarisation, coding, development of a working framework, and application of the analytical framework (Gale et al., 2013). Where Chapter four's FA adopted an inductive approach, analysis of these interviews implemented a deductive approach because they searched for associations in the determination of OPREE's acceptability and usefulness for future

studies. As figure 8 portrays, a *shortcut* was optimal because data were homogeneous. Therefore, deductive data was initially indexed, then summarised and categorised. Finally, critical explanatory themes were drawn from the summaries.

6.6.15 Completion of health outcomes

KA chose to administer the surveys personally because the optimal completion and return of self-reported questionnaires is notoriously problematic (Debois, 2016). This increased the risk of biases introduction with potential criticisms of an unconscious vested interest in the answers. Nevertheless, during the protocol formation, KA performed a trial of the surveys with two volunteers (both females aged 47 years and 70 years) who were known to him. After a short briefing, both volunteers independently completed the questionnaires. Erroneous answers transpired during feedback that strongly suggested a high level of amotivation to exercise; the direct opposite was known to be true. Therefore, despite best efforts, it is possible that skewed survey data emerged from subtle and unintentional intonations or non-verbal communication, but the risk of incorrect responses was judged to be higher than the risk of bias.

6.7 Results

6.7.1 Recruitment

A total of 27 potential participants were identified, 17 invitation letters were sent out to potential study participants, ten agreed to take part in the OPREE study (SBE plus OPREE). It was impossible to find out from members of staff why the other ten potential participants were not approached. All participants were female. Eight participants completed the study. Data from 27 case-control group patients were available (SBE only), 18 were female. Figure 12 details the flow of participants through the study.

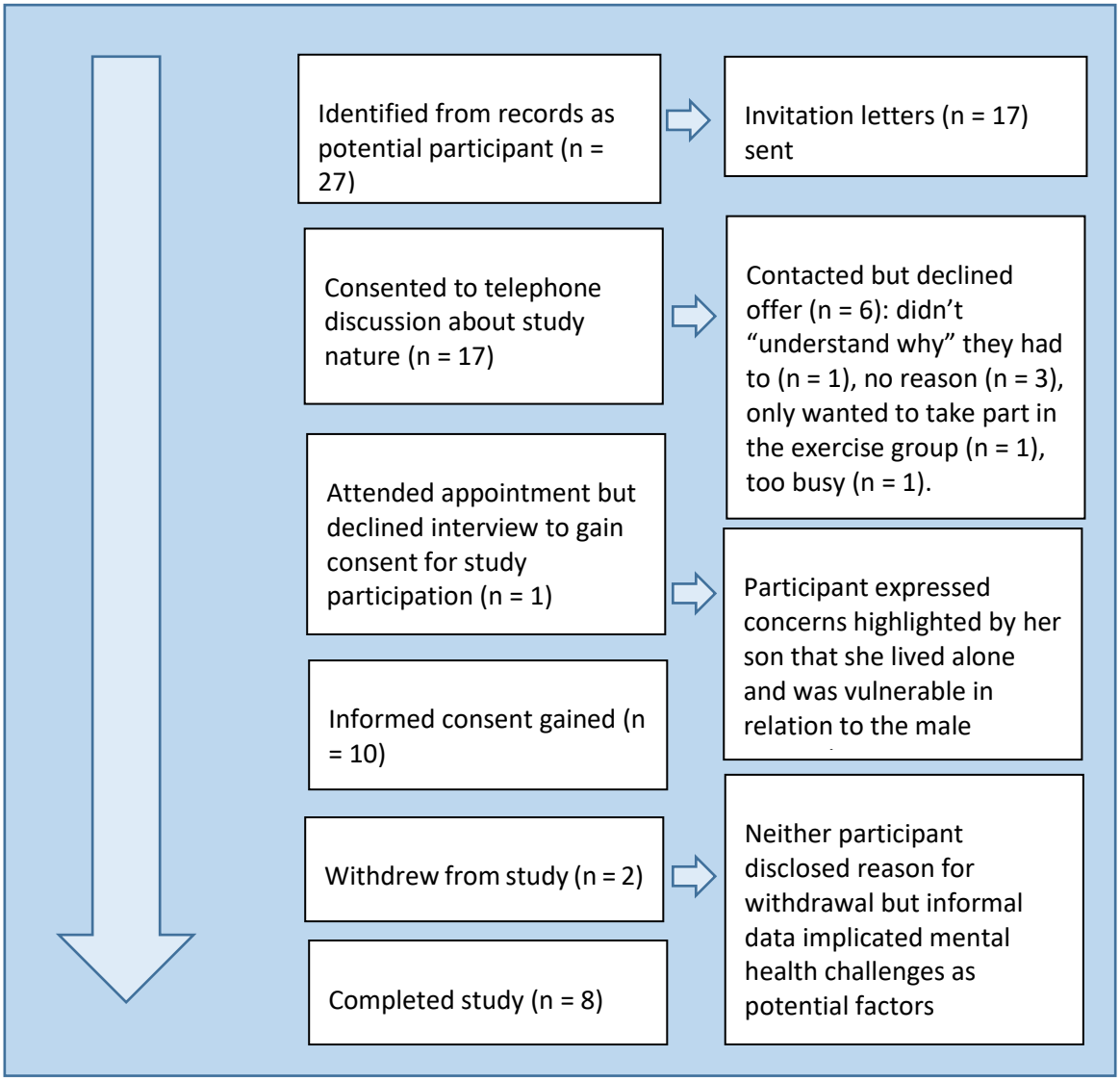


Figure 12: Flow of participants

The recruitment process took approximately eight hours as the result of liaising with clinicians and contacting participants. Additionally, formal study recruitment required approximately one hour for each participant; a total of ten hours.

6.7.2 Participant characteristics

Participant characteristics were collected during the study period to determine if they were sufficiently similar to be studied together and to inform future studies. Table 14 details these data and also provides a selected and illustrative quotation.

Table 144: Participant characteristics

Pseudonym and age	Sessions completed	Résumé and descriptive baseline interview data
Shirley (81years)	20	Lived with husband and was in regular contact with her family. Previously relatively independent and active. Enjoyed walking with her husband, shopping, and entertaining for special family occasions. Suffered a fractured hip and was increasingly fatalistic about her future physical independence to the extent that, where she previously used the stairs in shopping centres, she used lifts. She sustained a hip fracture which markedly reduced independence. *"I like to be out, and I like to be able to walk, and that annoys me that I can't walk as far as I would like to see different things. I enjoy going on holiday, and that annoys me that I can't do what I used to do"* (Line 21).
Jean (82years)	13	A widow of many years, Jean lived alone in a sheltered housing complex and had strong friendship circle. Regularly caught the bus into the city and enjoyed weekend seaside town bus trips. Intransigent that she exercised enough, she did not associate her reduced functional balance with the need to perform specific exercises. *"I've been for the paper this morning. … I'm walking fine, I haven't got any assistance anywhere, and I'm on my own. But occasionally I know that I'm veering a bit. Not in a dead straight line, veering just slightly. Walking as if I've had a glass or two"* (Line 251).

Pseudonym and age	Sessions completed	Résumé and descriptive baseline interview data
Maureen (69years)	20	Maureen previously suffered several strokes, struggled to physically and emotionally cope, and increasingly found herself socially isolated. She lived with her husband in a ground floor flat, but rarely had visitors despite being in regular phone contact with the family. Suffered several strokes approximately seven years previously which resulted in some evidence of anger and frustration because of her lost independence. *"I can't do it [exercise]. I used to because I was reasonably fit, I was until I was about 63 and that gets you down, it gets me down, it upsets me, it does. I don't like relying on [my husband] to do it. Where before I could do everything I thought I was Superman. No. Not very happy with how it's affected me in that way"* (Line 280).
Norma (83years)	20	As a widow, Norma lived alone in a bungalow. Two sons supported but largely independent. Throughout the early and middle part of her life, Norma had engaged in exercise but was progressively challenged by her physical health which reduced her ability to tolerate exercise. *"The last time I went, you know, I done the exercise swimming in the pool. Came back, caught the bus to come home, I came back off the bus, and it took me all my time to walk home from the bus. My legs just wouldn't take me; my feet just felt as if they were concrete and it finished me. I couldn't go anymore"* (Line 486).
Joyce (85years)	8	Joyce suffered cognitive impairment and lived with her 50-year-old son who also lived with learning disabilities. Having suffered previous negative experiences, she found it difficult to trust people, but had a very supportive daughter. Joyce enjoyed being very independent as a young adult, but this served as a bitter sweet reminder of her age. *"Exercise is putting one foot in front of the other. But as you say your bones aren't as like they used to be so every time you walk its clunk, clunk, clunk. At one time it used to be smooth"* (Line 582).
Jennie (73years)	20	Previously divorced and living in a third floor sheltered housing flat. Jennie was highly independent and had long engaged in general physical activities, especially walking. Regularly visited socially isolated

Pseudonym and age	Sessions completed	Résumé and descriptive baseline interview data
		older people. She lived alone and tried to use the stairs during her regular trips out. *"The alarm goes off about seven, and I'm usually up about quarter past. And then my exercises, I sit on the bed, got this exercise, but my brother-in-law gave me because I got problems with my knees, it's because I can't lie on the floor, I lie on the bed and put my legs up straight, one bent like that. I don't know whether, well you must know because you're a physio? And I put my legs straight up and try to push my lower foot forward. I try to do that with both legs before I get up out of bed"* (Line 767)
Marilyn (80years)	5	Marilyn was a retired teacher of mathematics and lived with her professionally qualified husband. Together, they ran their detached house together. Despite various reported health conditions, she tried to remain independent, but found it difficult. The study was performed during the winter which exacerbated the influence of her reported Seasonal Affective Disorder to the extent that she was considering withdrawal from the exercise classes during the baseline session. *"There's a lot of talk [before the exercise class started], a lot of which is not necessary, the two women and one of the women is non-stop talking about her holidays, about where she is going. They ask if everybody's got a Christmas tree up which I think is completely irrelevant"* (Line 877).
Joan (87years)	5	Joan lived alone in a bungalow as a retired public health and NHS scientific officer. Her son lived away but was in regular contact and visited as often as possible. She was a school sports champion, continued to exercise at University, and participated in sports throughout her life for enjoyment. She continued to regularly walk in the local park, but fell because of a balance problem. Joan was seriously considering withdrawal from the exercise programme because it did not meet her needs and was insufficiently intense. *"its not suited to what I need and enjoy. I said to you; it's like a class for five-year-olds."* (Line 1112).

Pseudonym and age	Sessions completed	Résumé and descriptive baseline interview data
Thelma (70years)	11	Thelma lived alone in a big sheltered housing complex with ample opportunity to engage in various activities, but didn't. She felt trapped because she looked after her disabled sister who passed away shortly after moving into the complex. Thelma considered that she took enough exercise as part of her previous work on the markets. Her dialogue suggested that she was depressed. *"I've never been a big believer in exercise at all. I've always worked and thought that was enough exercise. I worked and worked from 3 o'clock in the morning running my business until finished at one and it was non-stop. Cleaning, scrubbing and all that. I stood market days all day. I just never thought a lot about exercise"* (Line 1228).
Eunice (85years)	20	Eunice did not engage in formal physical activities, but led a busy life as a working mother. In later years, she cared for her husband who ultimately passed on because of ill health. During these years, however, she developed a robust sense of independence that was increasingly challenged by age related physical changes. She strived to be independent and resisted family recommendations to purchase a scooter. *"The whole body needs exercising, doesn't it, really to keep you in the best of health. The best that you can be at my age"* (Line 1368).

The histogram (figure 13) demonstrated that the whole sample's distribution was moderately normal (skew = -.502; kurtosis = -.414). Both samples' median age and ranges were similar. The median age of the case-control participants was 80 years (range 60 years to 95 years). OPREE participant median age was 82 years (range 69 years to 87 years). Conversely, a more positive kurtosis was evident in the OPREE sample (figure 14), which suggested a flatter and broader age distribution.

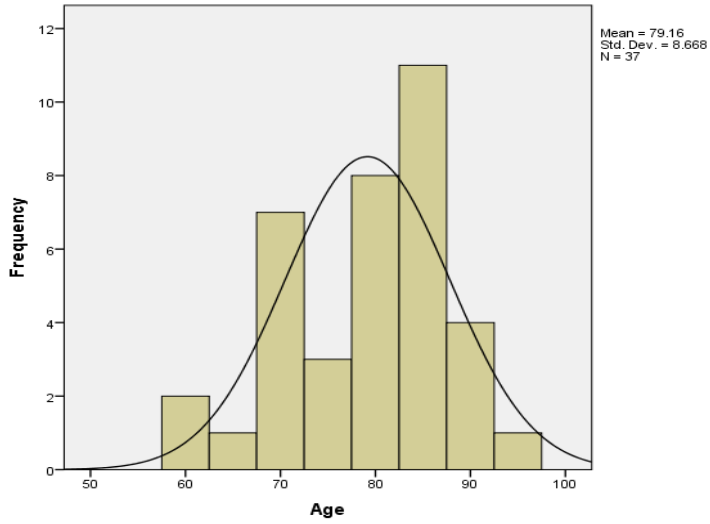


Figure 13: Whole sample age distribution



Figure14: Age distribution for case-control versus OPREE

6.7.3 Primary Outcome measure

While baseline data were available for all participants, exit data were only available for eight of the ten because two participants withdrew from the study.

SBE class attendance formed the primary measure. Out of a possible 20 sessions, overall median SBE class attendance was 11 sessions, this included the case- controlled and those participants who received the OPREE intervention. The histogram in figure 15 suggested that those who started the programme either withdrew within the first ten weeks or went on to complete it.

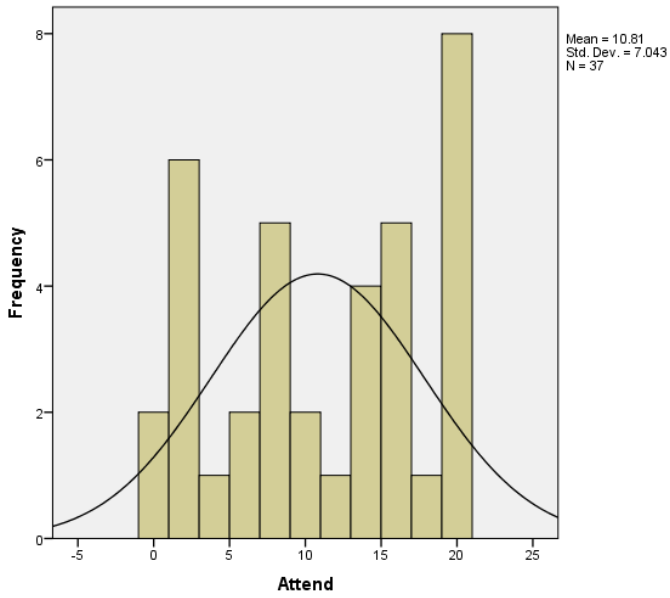


Figure 15: Whole sample attendance

Case control median SBE attendance was nine sessions (range 0 to 20 sessions; 45% attendance; IQR 2 to 15 sessions) and OPREE median SBE attendance was 15 sessions (range 5 to 20 sessions; 75% attendance; IQR 8 to 20 sessions).

Both case-control (-.064) and OPREE (-.329) were negatively skewed; bunched up toward the right and with a "tail" stretching toward the left. This finding indicated higher attendance rates in OPREE's group than the case control. Examining the variance with kurtosis, both case-control (-1.480) and OPREE (-1.758) demonstrated a flat distribution with several values at the extremes, but OPREE was more pronounced. Visual examination of case-control versus OPREE (figure 16) further showed variable case-control attendance, but most OPREE participants completed the programme.

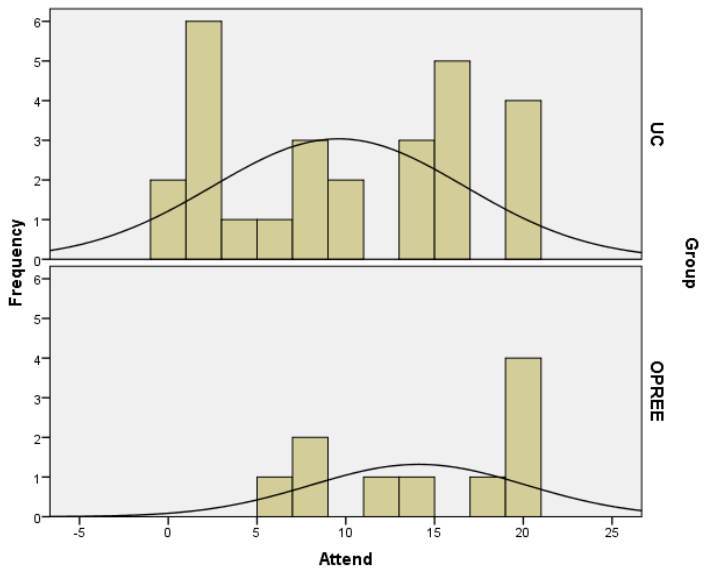


Figure16: Case-control versus OPREE attendance

The box and whisker graph plotted the attendance distribution's shape, central value, and variability (figure 17). Similar interquartile ranges, but different positions demonstrated a higher attendance of those receiving OPREE compared to the case control. Standard Deviations show this dissimilarity where the case-control group's (SD 7.09) variation was more considerable than OPREE (SD 6.05). Data revealed a difference of 30% where the control median attendance was 45%, and OPREE median attendance was 75%.

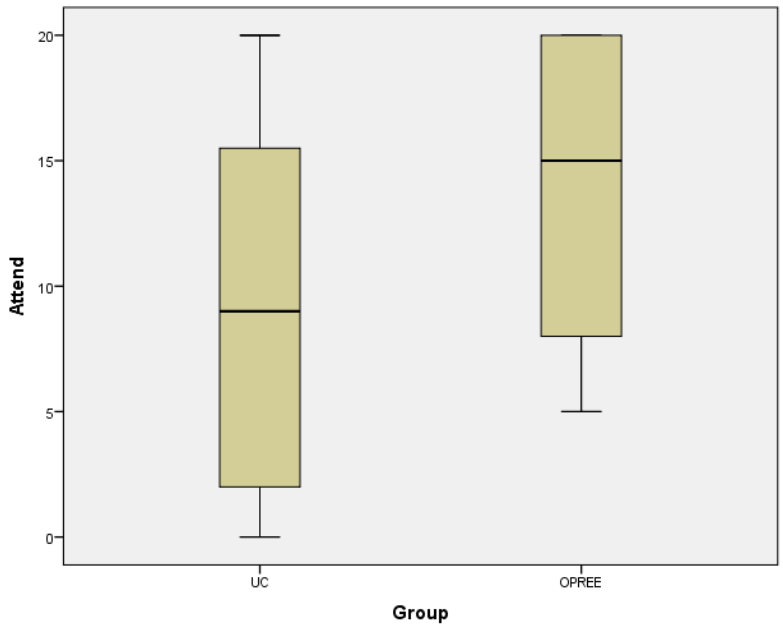


Figure 17: Boxplot OPREE versus case-control

These data indicated that OPREE facilitated the exercise programme attendance, but the sample was too small to test for effectiveness statistically.

6.7.4 Clinically Significant Difference

An electronic questionnaire further evaluated the clinical significance of these findings among healthcare providers. Once formed, 49 clinical researchers (Occupational Therapists, Physiotherapists, Psychologists, Nurses, and Medical Doctors) received an invitation to respond to a short questionnaire. The questionnaire included three answers, yes, no or I don't know, to the question:

"A recent feasibility study demonstrated that OPREE, an intervention designed to promote Older Peoples' Rehabilitative Exercise Engagement, increased the strength and balance exercise class (postural stability) attendance from 9 (usual care) to 15 (OPREE) sessions out of a potential 20. Please say whether or not you think this is clinically significant to you. In other words, would this increased attendance be significant enough for you to use the new intervention?"

Ten healthcare providers responded (20%). Of respondents, seven were female, eight were Physiotherapists, and two were Occupational Therapists. The median years of clinical experience were ten years, mode 27 years, and the range was four to 27 years. Seven believed that the difference between usual care and OPREE's intervention was a clinically significant difference. Three reported that they were unsure. Therefore, of these sampled healthcare providers, data suggested the difference to be clinically significant. Caution has to be adopted when interpreting such a finding

because this was a small sample; however, the finding suggests that OPREE has potential.

6.7.5 Secondary Outcome measures

The secondary outcomes comprised age, BREQ3, SF12, NEADLS, and TUG.

6.7.5.1 Attendance as related to age

While the sample had a normal distribution, the scatter plot suggested that no direct relationship existed between age and attendance (figure 18).

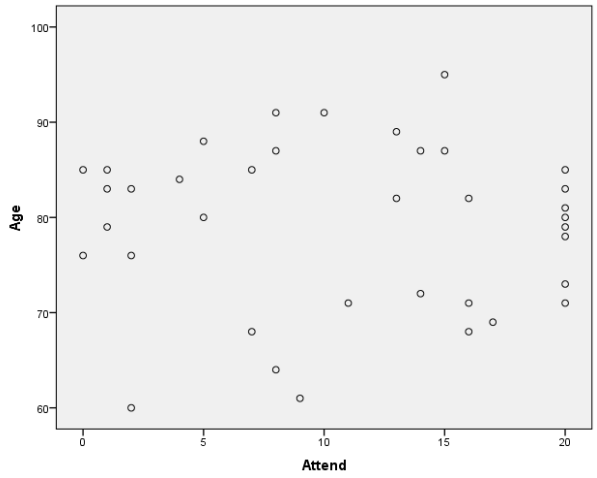


Figure 18: Scatterplot for age and attendance

These data affirmed that age did not represent an influential factor for attendance at the strength and balance exercise programme.

6.7.5.2 Behaviour Regulation Exercise Questionnaire Version 3 (BREQ3)

Table 15 details BREQ3 regulatory domains.

Table 15: Participant BREQ3 data

Pseudonym	Baseline behaviour regulation	Post intervention regulation
Shirley	Moderate level of introjected (2.5) and identified (2.5) regulation, but also had a moderate level of integrated (2.5) and intrinsic (2.0) regulation. Mild evidence of external regulation (1.25), but no evidence of amotivation (1.0).	Small improvement in introjection (-0.25), external (-0.25), and identified (+1.0) regulation. Small deterioration in integrated (-0.5) motivation but large improvement in intrinsic (+1.5) motivation. No change in amotivation (0.0).
Jean	Moderate to strong evidence of introjected (2.5) regulation. Not externally (0.0) regulated, but moderate to strong evidence of amotivation (2.25). Minimal evidence of identified (1.25), integrated (1.0), or intrinsic (0.5) regulation.	Small improvement in amotivation (-0.75) and introjection (-1.0). Small deterioration in external (+1.0) regulation, identified (+0.25) regulation and integrated (-1.0) regulation. Small improvement in intrinsic regulation (+0.5).
Maureen	Strong evidence of introjected (4.0), identified (3.5), and yet integrated (3.5) regulation. Moderate evidence of intrinsic (2.25) regulation. Minimal evidence of external (1.5) regulation and less evidence of amotivation (1.0).	Large improvement in introjection (-1.5). Small improvement in identified (-0.5) regulation. Small deterioration in integrated (-1.5) regulation. Small improvement in intrinsic (+0.5) regulation and amotivation (-1.0).
Norma	Strong evidence of intrinsic (3.5) regulation. Moderate to strong evidence of identified (3.0) regulation. Moderate evidence of introjected (2.5) and integrated (2.25) regulation. Mild to moderate evidence of amotivation (1.75), and mild evidence of external (0.75) regulation.	Large improvement in amotivation (-1.75). Small improvement in intrinsic (+0.5) regulation and external (0.0) regulation. Small deterioration in introjection (+0.5) and integrated (-.025) regulation. No change in identified (+0.0) regulation.

Joyce	Strong evidence of identified (3.75) and integrated (3.25) regulation. Moderate to strong evidence of intrinsic (3.5) regulation but moderate evidence of introjection (3.0). Moderate evidence of amotivation (2.0) and minimal evidence of external (1.0) regulation.	Large improvement in identified (-1.25) and integrated (-1.0) regulation. Small improvement in intrinsic (-0.25) regulation and introjection (-0.75). Large improvement in amotivation (-2.0). Moderate deterioration in external (1.75) regulation.
Jennie	Moderate to strong evidence of identified (2.75) and intrinsic (2.75) regulation. Moderate evidence of integrated (2.0) regulation. Mild evidence of amotivation (0.75) but less evidence of introjection (0.5). No evidence of externalised (0.0) regulation.	Small improvement in identified (+0.75, intrinsic, integrated (+0.75), amotivation (-0.5), and introjection (+0.75). No change in external (0.0) regulation.
Marilyn	Strong evidence of identified (3.75) and introjected (3.25) regulation. Mild to moderate evidence of intrinsic (1.75) motivation. Mild evidence of externalised (0.75) regulation but no evidence of amotivation (0.0).	Withdrew from the study, therefore no post-intervention data.
Joan	Solid evidence of identified (4.0) and integrated (4.0) regulation. Moderate to strong evidence of intrinsic (3.75) regulation. Moderate evidence of introjection (2.0). No evidence of externalised (0.0) regulation or amotivation (0.0).	No change in all domains apart from a small improvement in introjection (-1.0).
Thelma	Suggestion of ambivalence throughout. No evidence of amotivation (0.0) and reported strong integrated (4.0), intrinsic (3.5), and identified (3.75) regulation. Mild evidence of introjection (2.0) but denied external (0.5) regulated.	Withdrew from study, therefore no post-intervention data.

Eunice	Strong evidence of integrated (4.0), intrinsic (3.5), and identified (3.75) regulation. Moderate evidence of introjection (2.0). No evidence of amotivation (0.0) but mild evidence of external regulation (0.5).	No change in any domain

6.7.5.3 Amotivation

Within this domain, high scores represented low motivation to exercise. Baseline median score was 1 (SD = 0.76) indicating a minimal motivation to engage in exercise. The post-intervention median score was 0 (SD = 0.58) indicating their motivation had improved over time (figure 19).

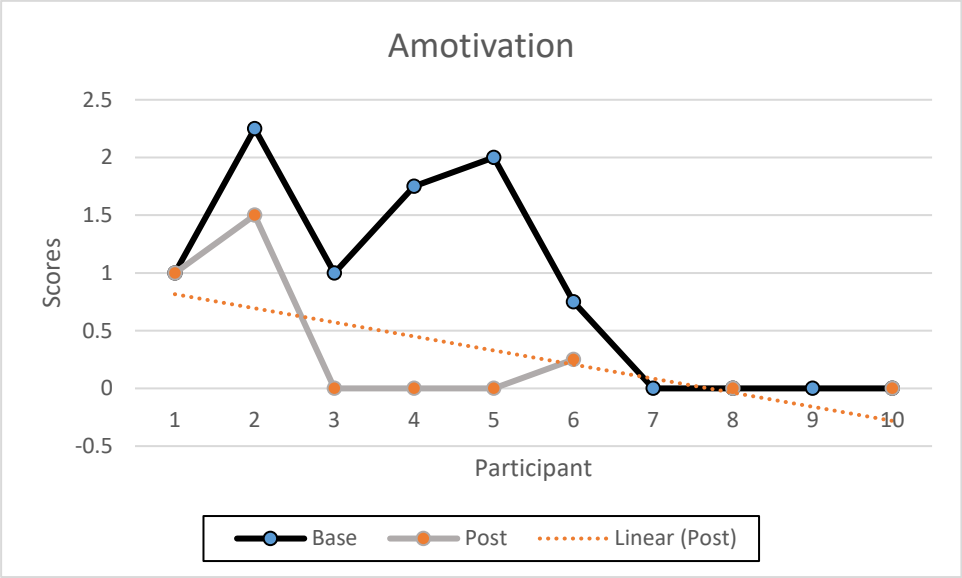


Figure 149: Amotivation

6.7.5.4 Extrinsic regulation

Median baseline score was 0.75 (SD = 0.55) indicating high levels of extrinsic regulation, and post-intervention median score was 0.03 (SD = 0.92) indicating lower levels. In the case of extrinsic regulation, this represented a positive outcome (figure 20).

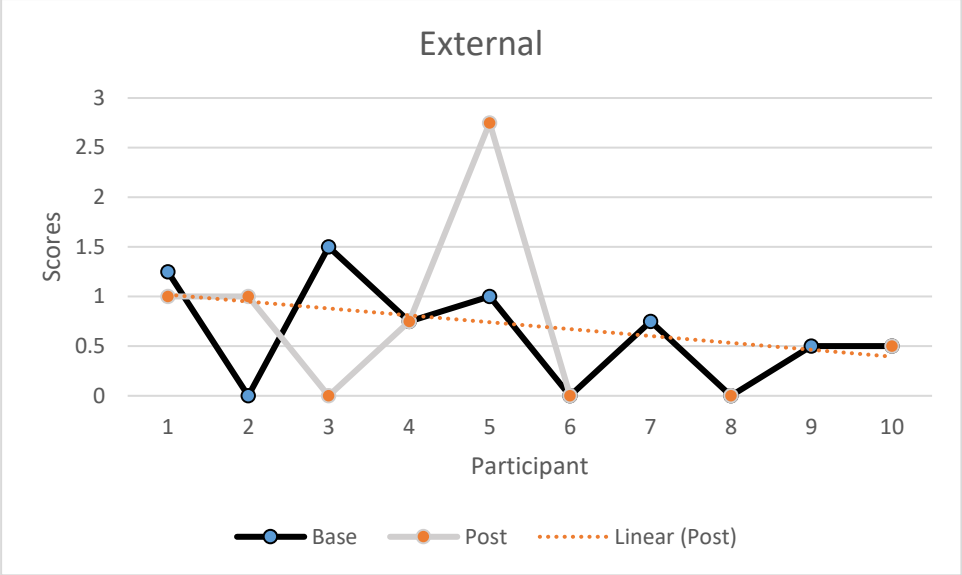


Figure 20: External behaviour regulation

6.7.5.5 Introjected regulation

Baseline median score was 2.50 (SD = 0.91) indicating that participants felt obliged to exercise, and the post-intervention median score was 2.13 (SD = 0.77), which showed higher engagement. Therefore, exercise attendance might potentially have improved because of reduced introjection (figure 21).

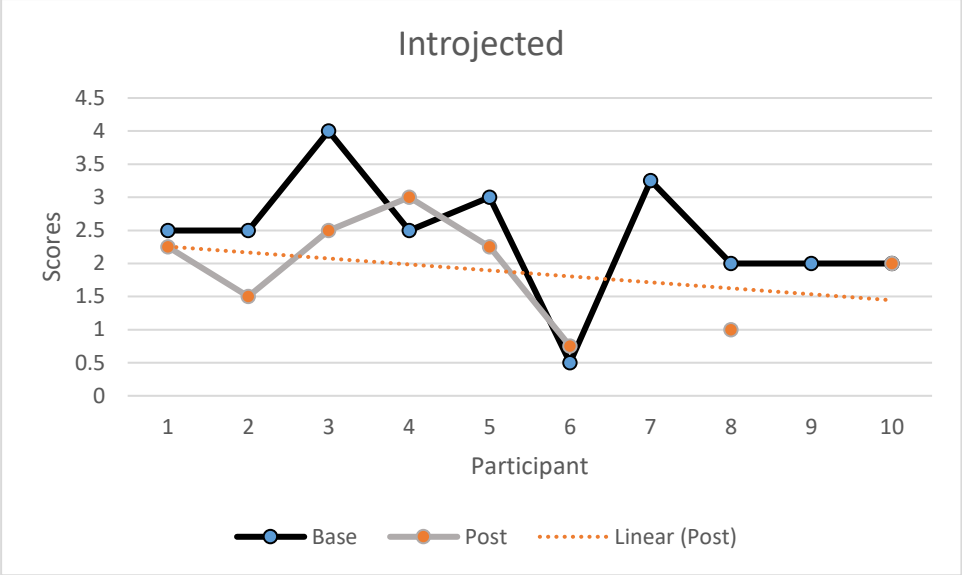


Figure 21: Introjected behaviour regulation

6.7.5.6 Identified behaviour regulation

Baseline median score was 3.50 (SD = 0.82) which indicated that participants exercised for an identified reason, and the post-intervention median score was 3.25 (SD = 0.80), which showed a small improvement. In this case, identified regulation slightly improved which could potentially account for short to medium term improved group attendance; but not in the long run (figure 22).

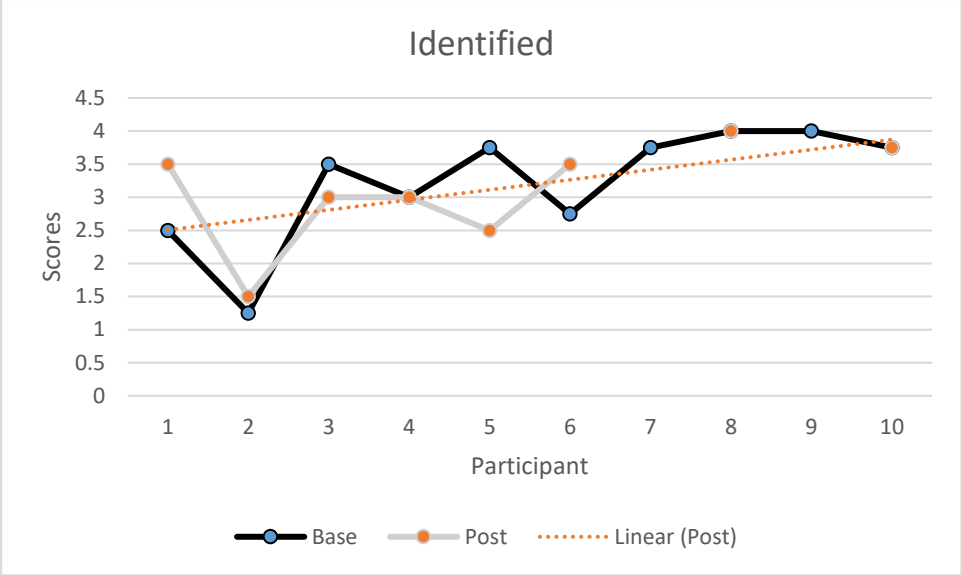


Figure 22: Identified behaviour regulation

6.7.5.7 Integrated behaviour regulation

Baseline median score was 2.13 (SD = 0.99) and post-intervention median score was 2.13 (SD = 1.28). These data indicated that the intervention did not change this domain. Thus participants identified themselves with the values of exercise but were still yet to embrace these (figure 23).

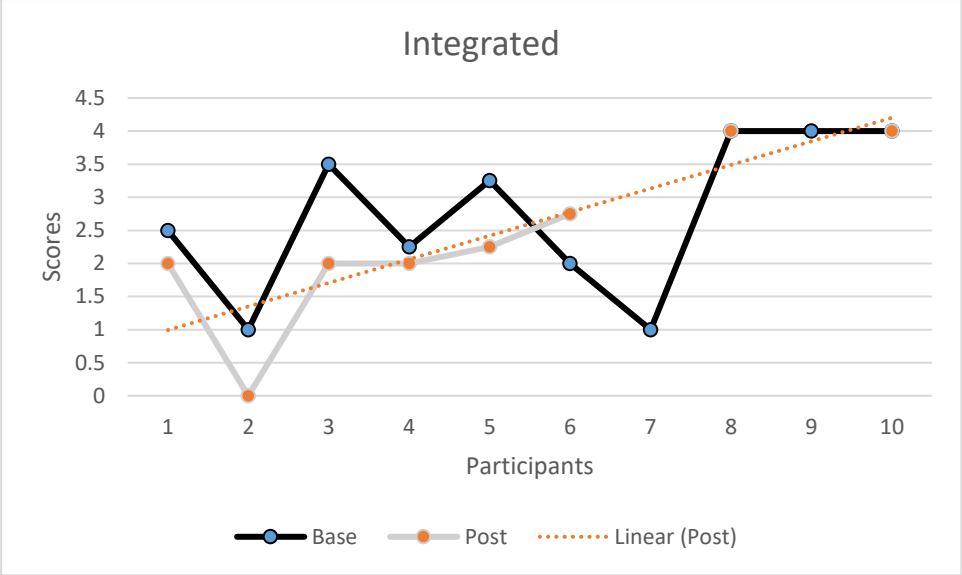


Figure 23: Integrated behaviour regulation

6.7.5.8 Intrinsic behaviour regulation

Intrinsic behaviour regulation characterises the only domain where an older person is more likely to attend an exercise group in the long-term because they either enjoyed or found the experience interesting. Baseline median score was 3.13 (SD = 1.06) and post-intervention score was 3.38 (SD = 0.94), which suggested improved levels. This difference of 0.25 in scores, is small, but in a small sample, the significance could not undergo testing (figure 24).

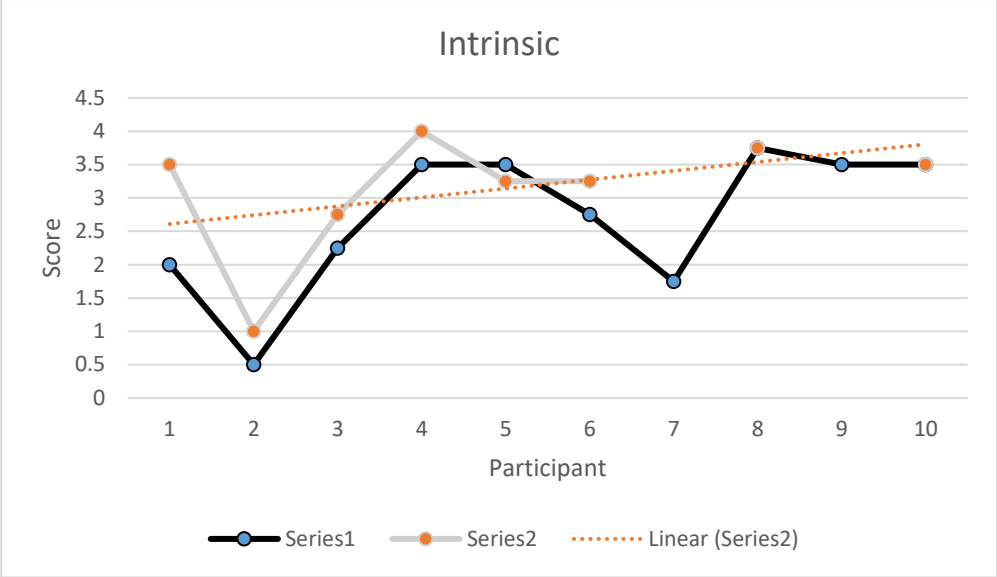


Figure 24: Intrinsic behaviour regulation

Together with figures 19 to 24 and referring to *Cohen's d* convention (Cohen, 1977), Table 16 demonstrated large improvements in two domains, a medium improvement in one domain, a small change in two domains, and no change in one domain.

Table 156: BREQ 3 summary data

Domain	Median	Med' diff.'	Change and trend
Amotivation	1.00 0.00	-1.00	Large change suggesting **trend toward efficacy.**
Extrinsic	0.75 0.03	-0.72	Large change suggesting **trend toward efficacy.**
Introjection	2.50 2.13	-0.37	Medium change suggesting **trend toward efficacy.**
Identified	3.50 3.25	-0.25	Small change suggesting **minimal efficacy.**
Integrated	2.13 2.13	0.00	No change suggesting **no efficacy**.
Intrinsic	3.13 3.38	+0.25	Small change suggesting **minimal efficacy.**

(Median top figures = baseline; bottom figures = post-intervention)

6.7.6 Short Form 12

Figures 25 and 26 illustrated individual baseline and post-intervention responses for the physical component summary (PCS) and the mental component summary (MCS) respectively. Missing data resulted from participant withdrawal (n = 2).

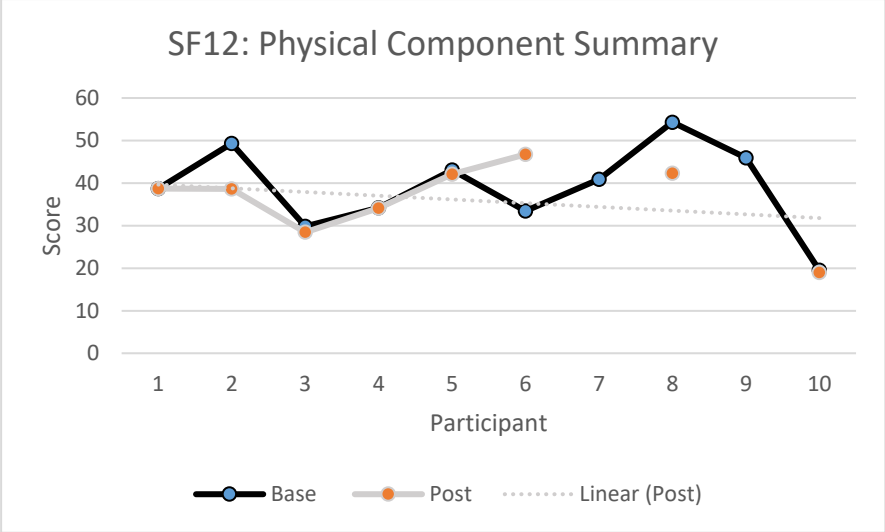


Figure 25: SF12 PCS

These baseline data demonstrated only two participants' perceived physical health to be above the normative data value of 50%. The linear trend line demonstrated that this perception deteriorated by the end of the study.

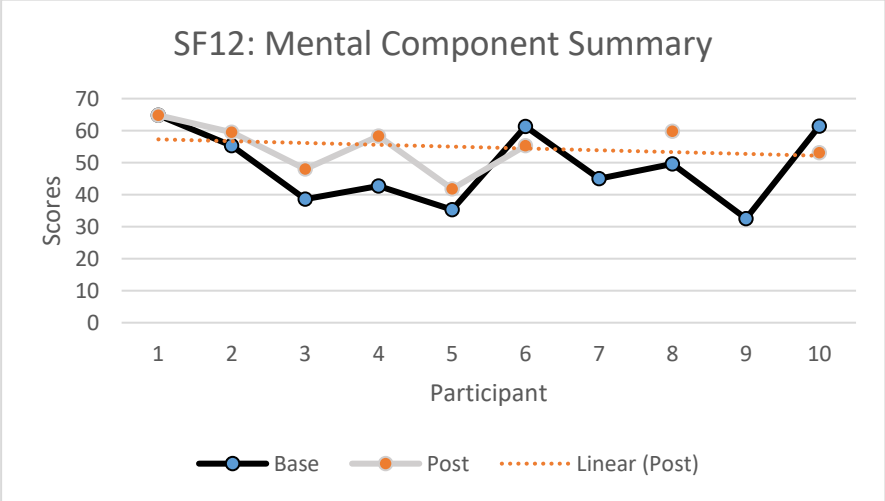


Figure 26: SF12 MCS

These data illustrated that four participants perceived their baseline mental health to be above the US general population's norm of 50%. The linear trend line showed that this perception improved by the end of the study and six participants perceived their mental health to have improved.

Figure 27 (legend in foot note) provided more detailed information, where physical role, general health, vitality, social functioning, emotional role and mental health all improved. However, physical functioning slightly deteriorated despite a reduction in pain. When interpreting these findings, caution is required because of the small sample size.

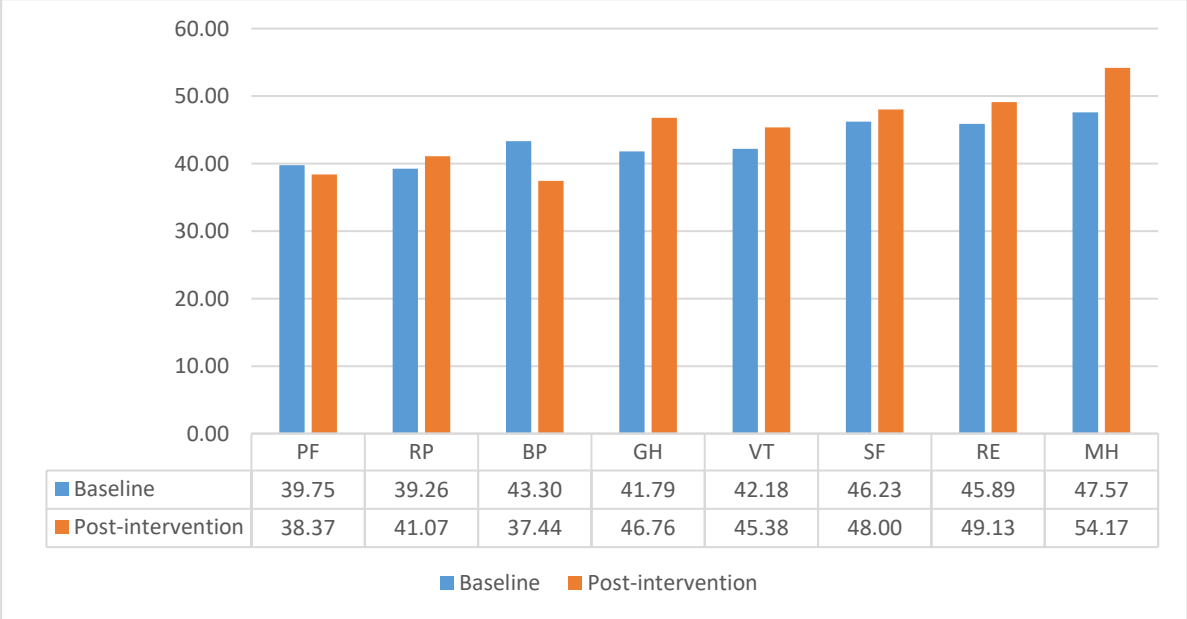


Figure 27: SF 12 Domains[1]

[1] **Figure 19 legend:** PF = Physical functioning, RP = Role physical, GH = General health, BP = Bodily pain, VT = Vitality, SF = Social functioning, RE =Role emotional, MH = Mental health.

6.7.7 Nottingham Extended Activities of Daily Living Scale (NEADLS)

Figure 28 demonstrated baseline median score as 17.15 (SD = 3.59), and post-intervention median score as 19.00 (SD = 6.18). Self-rated functional levels improved, and the difference between baseline and, given the sample size, post-intervention levels of 1.85 points bordered on clinical significance, but this requires further investigation.

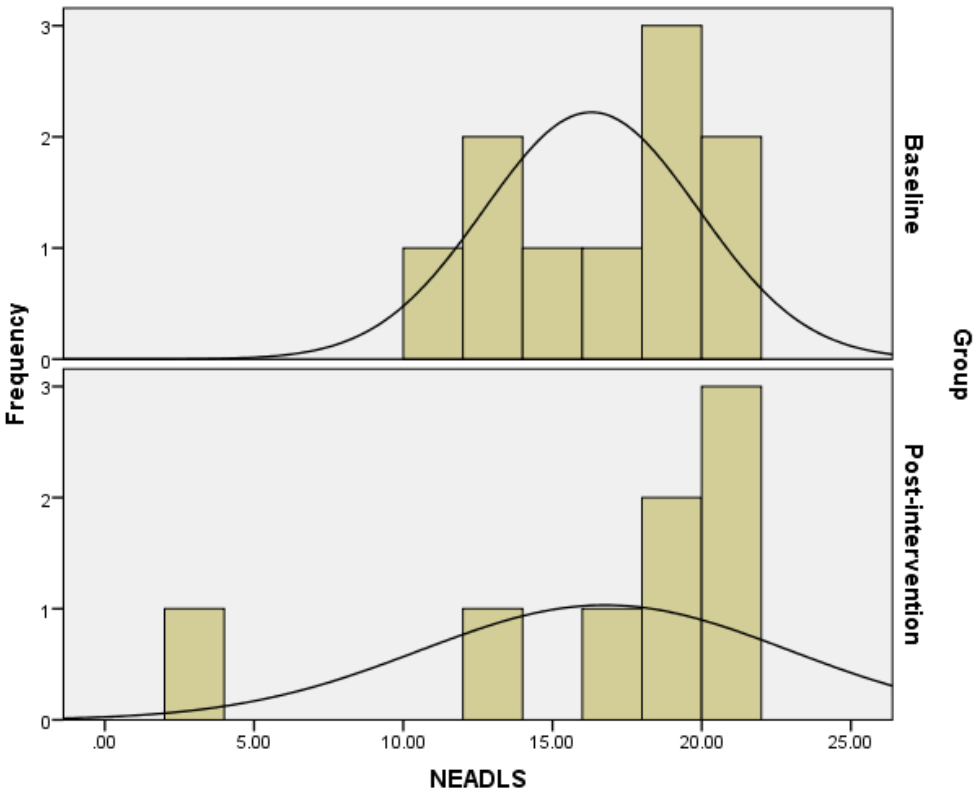


Figure 28: NEADLS comparative distribution

6.7.8 Timed Up and Go

Baseline TUG data were available for nine participants, but this reduced to two at post-intervention. This finding replicated service evaluation data,

and therefore, no analysis of TUG occurred. The median time at baseline assessment was 19 seconds (range 11 to 41 seconds). At the exit point, median time reduced to 13.5 seconds (range 9 to 18 seconds).

6.7.9 Outcome measures data summary

For ease of clarity, Table 17 summarises the quantitative findings.

Table 167: Feasibility study quantitative scores

Outcome measure	Baseline assessment	Post-intervention assessment	Trend toward efficacy?
BREQ3	Amotivation = 1 Extrinsic = 0.75 Introjection = 2.5 Identified = 3.5 Integrated = 2.13 Intrinsic = 3.13	Amotivation = 0 Extrinsic = .03 Introjection = 2.13 Identified = 3.25 Integrated = 2.13 Intrinsic = 3.38	**Yes** Large changes in amotivation and extrinsic regulation. A moderate change in introjection. Small changes in identified and intrinsic regulation. No change in integrated regulation.
SF12 Physical Component Summary	70% below US Norm 30% of US Norm	88% below US Norm 12% of US Norm	**No**
SF12 Mental Component Summary	40% below US Norm 20% of US Norm 40% above US Norm	12% below US Norm 25% of US Norm 62% above US Norm	**Yes**
NEADL	Median score 17.15	Median score 19.00	**No**, but evidence of ceiling effect
Attendance	N/A	Case control median attendance = 9 sessions. OPREE median attendance = 15 sessions	**Yes**

These findings suggested an overall trend toward efficacy.

6.7.10 Adverse events

Neither OPREE nor the SBE programme reported any adverse events during the study period.

6.7.11 Missing data

All participants agreed to complete the surveys at baseline. Of the ten recruited participants to OPREE, two withdrew. Marilyn withdrew after the fifth exercise class and the second OPREE session but did not disclose the reason to KA. Clinical staff, though, reported that she revealed a history of Seasonal Affective Disorder and found both the SBE and research involvement to be burdensome. Thelma withdrew after the first OPREE session and did not disclose the reason for her withdrawal to KA. At baseline data capture, she divulged anxiety and depression. She continued to attend the SBE intermittently but withdrew after 11 sessions. Except for the two participants who withdrew, all surveys were also completed at the exit point. Baseline TUG data was collected for eight of the ten participants, but only two completed tests at the exit point could be included. Therefore no analysis occurred.

6.8 Process evaluation results

As often found in qualitative analysis the findings are combined with the discussion where appropriate. The overall findings are then discussed in the next section with the quantitative data.

6.8.1 Feasibility

Excluding travel, each interventional session lasted an average of 45 minutes, with a range of approximately 30 minutes to 75 minutes. Accordingly, the interventional sessions (n = 40) required a total of about 23 hours, approximately three hours per participant. Of the ten participants recruited to OPREE, eight completed all four OPREE sessions. All participants reported the intervention as acceptable; indeed, several participants were disappointed that the sessions came to an end.

6.8.2 Fidelity

Of a potential 36 sessions, nine were independently reviewed with the use of the Motivational Interviewing Treatment Integrity tool, an audit of 25%. Open questions, complex reflections, reflections to questions ratio all crossed the minimum behaviour threshold. The global spirit score was slightly below the threshold because of the difficulty in evocation and

supporting autonomy. MI adherent behaviours failed to reach the threshold because of the tendency to provide advice and direct. Empathy was evident throughout. MITI data detailed that participant motivational levels increased, which would suggest the effective delivery of MI. At 3.8 out of 5, empathy levels were higher than the beginning proficiency of 3.5. Similarly, at 3.3, direction nearly met the proficiency level of 3.5.

6.8.3 Framework Analysis

Three themes emerged from the Framework Analysis: personalised support and feedback, incentivisation, and adaptability.

6.8.3.1 Personalised support and feedback

All participants interviewed said that they valued the feedback given during the OPREE intervention and felt this had considerably helped them remain engaged with the SBE classes. All participants reported some form of physical or mental health condition that impaired their ability to continue attending the exercise classes. Therefore, participants required a level of personalisation such as attentive listening, appropriate signposting to address ailments that impeded exercise adherence, or support during an acute illness:

""I'm finding it a bit hard to focus for any length of time, but you're a good listener". [Do you think that's important?] "Oh definitely, yeah."

(Maureen, line 765).

"I've enjoyed you coming. I've enjoyed listening and learning about it. Learning how these things all help, it was useful … [So rather than being a pure psychological intervention. It should actually come in as a physical intervention as well] "Yes, yes" … I couldn't have gone back any sooner because of the [prolonged] cold … I think you did give me the confidence to go back"

(Eunice, line 2218).

"I've enjoyed you coming. I've enjoyed listening and learning about it. Learning how these things all help."

(Eunice, line 2092).

This personalisation extended to the recruitment of family members to support cognitive impairment:

"If Kevin and I didn't get involved, you wouldn't have gone" [to the exercise class] (Joyce's Daughter) "Not really. Unless I knew someone that was interested in it"

(Joyce, line 1217).

Several participants believed that they benefitted from this highly personalised support because an experienced healthcare professional understood the context in which OPREE was delivered:

"Somebody that knows what they're talking about ... I like to talk to people who have got something to talk about. Who're experienced."

(Norma, line 1028).

"You're telling me why I'm doing these exercises and what they're for … I think it's; I know you're qualified. Whereas somebody that's been, that had a bit of training ... Like somebody who's only just, just had a few weeks training on it wouldn't be … It may be because, because you're telling me directly, rather than you telling half a dozen people … It makes me more motivated; it makes me want to do it. You know what I mean?"

(Jennie, line 1440).

"You have given her a bit of confidence really, and what we are doing is on advice rather than ad hoc [comments]

(Shirley's Husband, line 146).

Of note, signposting was useful for Joyce in supporting her cognitive impairment and reducing her social isolation:

"Somebody to go with you is a good start of the show, but going on your own, and nobody knows. And they're as closed as you are. It's a waste of time going". [So part of it is an understanding of what's out there?] "Yes". [And part of it is company to go somewhere?] "Yes"

(Joyce, line 1182).

While dialogue demonstrated that OPREE was acceptable because it was naturalistic, flexible, supportive, informative and motivational, these factors intertwine and occasionally overlap with its perceived usefulness. The interview data highlighted that the naturalistic face to face approach "*is the best"* (Joan, line 1875). Several other participants reflected that OPREE was good because it had been tailored to their situations. Shirley described the sessions as "useful" (line 201), and her husband described that the OPREE intervention had increased confidence and motivation to attend the exercise classes.

6.8.3.2 Incentivisation

An important theme that emerged from all the interviews was that the participants appreciated the 'nudges' to continue attending the classes. :

"I've looked forward to you coming. I've done, when you've made suggestions. I've tried to carry them out. And I've done, when you've made me promise to do things to do things that I've done. And it's been great, yes"

(Norma, line 1042).

[So do you think I've helped you stick with the programme or not?] "Yes, yeah, because you keep on asking me if I'm still going [laughter]"

(Maureen, line 799).

[If I hadn't been coming, would you have stopped before now?] "I think I might have done". Yes, I think I might have done"

(Jean, line 446).

I sometimes think Kevin said something about doing that the other day. When you called in, it jogged my memory. I'm not saying hundred percent at all, but it [OPREE] has helped me"

(Jean, line 413).

"You've made me promise to do things to do things that I've done. And it's been great, yes"

(Norma, line 1042).

The interviews, therefore, highlighted that several participants valued the provision of various tips about integrating specific exercises that motivated them to continue with the exercise classes.

6.8.3.3 Adaptability

Joan, Joyce and Eunice all benefitted from the flexibility of OPREE. Joan was contemplating withdrawal from the SBE classes because they were insufficiently intense, but reported that she continued to attend the classes because she was signposted to the same programme but at a more intense level. Joyce's daughter was recruited to support her mother who in turn was signposted to a day centre to reduce the social isolation that threatened her exercise adherence. Eunice developed a severe chest infection that caused her to frequently cough and this curtailed her exercise class attendance. Rather than pursuing the MI strategy, Eunice reported that OPREE's flexibility supported her early return to the classes.

These findings reinforced the need for OPREE to adopt a flexible needs supportive strategy, especially in the establishment of an optimal and acceptable dosage. However, although Maureen's dialogue suggested that the studies dose was optimal, Shirley reported that she still retained a fear of falling that would have benefitted from further sessions. Conversely, Jean, would not have benefitted from further sessions and her intervention

could have been shorter. Whereas Joyce benefitted from continuing involvement:

"Well, I would keep it about the same". [What about the time, the length, that I'm here for?] "… I mean, it's just my health problems, I just get tired, I can't take any more in after a bit (Maureen: 737) ... I'm finding it a bit hard to focus for any length of time."

(Maureen: 765).

"… maybe …an after group where you just chat … with age groups of mum's own elder community. Maybe that would alleviate some of the low morale. You're going to get better physical health in the communities. I think it would be cost-effective financially"

(Joyce's daughter, line 1340).

"Oh, very useful". "It's really made me think, you know, I can do more"

(Shirley, line 217).

"It depends on the person really. Their outlook. I would recommend it for them to try. There's no harm in doing that. Same as I have done. It is up to the individual. … I think it would be a waste of money for the NHS ... When perhaps, some people, not all, but some people could manage to do something like it themselves without having to get the NHS to do it"

(Jean, line 556).

Jennie thought that the dosage was *"about right"* (line 1633), but Joan perhaps encapsulated the requisite flexibility, dependent on the given participant's individual needs.

"Well, it very much depends on the person that you are going to. Possibly six sessions"

(Joan, line 2029).

These findings supported the need for a flexible approach that combined the elements of OPREE.

6.9.4 Protocol violations

No protocol violations occurred.

6.9 Discussion

This study achieved the primary product of an increased level of attendance, demonstrated that the delivery of OPREE was practicable and could be delivered by NHS staff in a real world setting. Fourteen patients referred to SBE were also offered the intervention. Ten accepted (intervention group), and eight of them completed OPREE. A contemporary cohort of 27 participants who only received SBE formed the control group. Intervention participants attended a mean of 15 SBE sessions (75% attendance). Control group SBE attendance was a mean of nine sessions (45% attendance). Seven of ten surveyed clinicians believed the difference was clinically significant. The eight participants who completed the OPREE intervention, enjoyed and appreciated the intervention and felt it was worthwhile.

As participants started to identify with engaging with exercise behaviours, attitudes towards exercise behaviour in the intervention group changed from being unmotivated to exercise, to exercising for their own reasons and not because they felt pressured by others. OPREE did not improve SF12 physical domains (physical function or bodily pain), but mental health domains all improved (role physical, general health, vitality, social functioning, and role emotional). NEADLS median scores improved from 17.15 to 19.00 (maximum score 22). Reported useful components were information giving, signposting, regular prompts and motivation to attend the SBE programme. The informed, trusted, attentive, supportive and

flexible professional also formed an essential component. However there were a number of issues that need resolving before a randomised controlled trial can be completed.

An informal subgroup analysis suggested that adherence rates could not be explained purely by participant age or the geographical location of exercise class venues, other contextual factors were significant. For example, two sites had similar referral to attendance ratios (50%), but the average age in one was 80 years and 76 years in the other. Two sites were set in less affluent areas with similar average ages (81 years), but dissimilar referral to attendance ratios. One venue was in an urban area with excellent public transportation and car parking and demonstrated a 100% referral to attendance ratio. Conversely, another site was set in a suburban area and was a purpose-built large retirement complex with over 400 residents and situated at the top of a gentle hill on the outskirts of a former council estate, where venue access was an hourly bus, taxi, or private transport and demonstrated a 67% ratio. These descriptive data suggested that age or socioeconomic status alone might not represent attributable factors for exercise class engagement, therefore, future studies need to explore this.

A smaller than expected number of potential patients were recruited, possibly because recruitment was reliant on routine clinical staff with no extra resources. Thus, to ensure the optimal identification and recruitment for future and more extensive investigations, research teams need to ensure the presence of a named clinical champion who can proactively

facilitate optimal participant recruitment or utilise clinical research networks. The NEADL scale did not appear to be suitable with this particular population due to a ceiling effect; an alternative measure of functional ability is, therefore, needed. Although the TUG is quick to use and recommended within national guidance (Royal College of Physicians, 2016), study evidence suggested that it might not be suitable if the NHS staff are required to complete it as part of their clinical job. However, post hoc discussions also suggested that the omission was a data anomaly, and clinical staff were collecting the data. The SF12 is suitable as a research tool. It remains unclear whether the BREQ3 is suitable for more extensive research studies, but there are suggestions that it might be clinically useful. This suggestion requires further investigation in more extensive studies. A future randomised controlled trial is conceivable and required to assess the effectiveness of the OPREE intervention.

6.10 Strengths and limitations

Except for the two participants who withdrew from the trial, all planned surveys were completed. However, this study was limited to a restricted group of people who had already decided to join an SBE programme. As is common in feasibility studies, there were also few participants, but the relative homogeneity of the group (Guest et al. 2006) suggested the number to be sufficient. Equally, KA conceived, developed, and performed

the interviews and interventional sessions; this indeed was a limitation that might have influenced the interview outcome from the perspective of both the participants and the interviewer. However, KA was aware of this potential positive bias and continually sought to mitigate the risk through neutral, open questions. Similarly, given the contextually limited resources associated with such Doctoral studies, no one else could have interviewed respondents or delivered the intervention to participants. Additionally, it is possible that loyalty or a preference for the investigator's attentive listening (KA) resulted in erroneous findings. Such attentive listening is key to therapeutic dialogue and represents a strength of the intervention. Future and more extensive studies will require adequate training for team members. Finally, several participants reported a sense of obligation to attend the programme because they were in a research trial, or because of a personal commitment to KA; interventions need to reduce this.

A strength of this study is that it aimed to ensure that any future study will be well designed and useful (Hawe et al., 2004) because complex interventions often undergo post hoc tailoring that result in the incorrect intervention delivery (Craig et al., 2008). Nonetheless, one apparent limitation emerged because of the difficulties in masking therapies from the patient and therapist. It is, nevertheless, hard to develop and conduct non-biased high-quality clinical trials of rehabilitation. This potential bias is particularly possible when the person providing the intervention is also the person doing the research (Legg et al., 2007).

A serious potential limitation is that the participants were self-selecting and therefore they might have attended more SBE classes than the case controlled patients even if they had not received the OPREE intervention. Interview data implies that this is not the case; most said they would have given up if they had not had the OPREE intervention. Nevertheless, they might have been biased due to the interviewer also being the OPREE provider. The sample population was thus potentially unrepresentative of the intended populace, but randomisation was not practical in this project despite being the most robust method of preventing selection bias in such trials (Craig et al., 2008).

6.11 Relation to existing literature

OPREE is based on the Self-Determination Theory (SDT) and Motivational Interviewing (MI). When conceived, MI was inductive, process and practitioner-focused, but an epistemological, methodological and practical shift meant that it became more deductive, research-outcome, and confirmatory-focussed (Hilton, June 2017) (personal communication). As such, this potentially accounted for contradictory results with studies purely utilising MI (Livingstone and Gaffney, 2016a). Fidelity measurement demonstrated that OPREE's strength was its impurity. This is supported by a systematic review of reviews where purely cognitive strategies and behaviour change techniques were demonstrably less suitable for older

people than more meaningful personal motivators (Zubala et al., 2017). Of course, such impurity has the limitation where future incarnations can be misinterpreted; therefore an intervention handbook will be designed to prevent the dilution of vital components, or vice versa.

MITI epitomised the gold standard of sessional fidelity measurement (Hilton et al., 2016). Independent evaluation with MITI suggested that despite sub-optimal fidelity feedback, participants increased their motivation to exercise. Nonetheless, by focussing on an outcome measure versus the process itself, the essence of the intervention itself might become unclear. Increasingly, calls for a return to a more inductive, practitioner and client-focused approach are being made (Hilton et al., 2016). Thus, OPREE's *active ingredient* (Medical Research Council, 2000) might be that the multi-faceted approach allowed for a flexible approach that was guided by the spirit of MI but was also theoretically underpinned by SDT.

When exploring influential factors that affect the exercise classes' attendance, two outcome measures demonstrated data that further studies should investigate. BREQ3 revealed that the participants were less regulated by external factors but again exercised for some definite and personal purpose. Equally, the participants failed to internalise exercise engagement. Further, SF12 showed that perceived physical functioning deteriorated despite a reduction in bodily pain. Conversely, all other domains improved, the most significant being general and mental health. It is thus possible to argue that OPREE supported both autonomy and the

perceived competence to exercise. Nonetheless, four sessions at monthly intervals were able to improve exercise class attendance but, potentially because the participants retained a sense that they exercised to aid the management of age-related factors, not long-term exercise engagement. The suggestion therefore was that the intervention needed to adopt a more flexible approach in relation to its duration.

As an example of this, Shirley's health-related quality of life did not significantly change during the intervention, but NEADLS demonstrated a relatively high functional level. She was already motivated to exercise but had fallen and sustained a fractured hip. TUG data (one of only three collected sets) also showed a reasonable level of functional mobility (baseline = 11 seconds, exit = 9 seconds). Data though, revealed that she improved her intrinsic regulation, reduced her integrated regulation, but increasingly exercised for an identified reason. Despite these improvements, she refused to run for a bus due to an ongoing fear of falling, and a future stumble could potentially reverse all gains made as the result of OPREE. Conversely, Jean had suffered an acute minor illness which highlighted a balance deficit. Nonetheless, she remained relatively active in her social life and was intransigent in her belief that she did not require SBE training. Despite, best efforts, she withdrew from the exercise programme after OPREE concluded. Shirley would have benefitted from a longer intervention that could support long term exercise engagement, but Jean would not.

Arguably, any possibly low interventional efficacy might arise from an inadequate screening of the readiness to engage in exercise before the referral (Orrow et al., 2012). Of interest, the protocol design allowed for the use of BREQ3 as a research outcome measurement tool. However, the first two trial sessions identified its dual usage within the trial as an integral tool. Therefore, referrers might benefit from the use of BREQ3 by surveying patients and supporting appropriately. Nonetheless, in its current form, OPREE appeared acceptable, tolerable, and practicable. However, future incarnations should target the higher levels of extrinsic behaviour regulation with the aspiration of internalising older peoples' exercise behaviours. This feasibility study sample size was, nevertheless, small and this suggestion would require further assessment in a more comprehensive study.

Equally, the SBE class formed a recognised and appropriate control as the usual care, but the intervention itself promoted activities, which potentially reduced the estimate of the intervention effect (Legg et al., 2007). Notably, literature and interview data identified the need for future forms of OPREE to be delivered by experienced and appropriately trained professionals who have skills relevant to the setting. To explain, disengagement with recommended lifestyle changes remains a frequent obstacle to realising the health benefits. While behavioural counselling can improve adherence to exercise programmes, when developing an effective approach, providers need to consider the individuals' motivation for change and the particular

reasons for resistance (Stonerock and Blumenthal, 2016). Resistance can emerge in many forms and includes a fear of exercising safely in the presence of a given health condition. Therefore the provider requires a relevant understanding alongside the behavioural counselling skills. As an example, Langer and colleagues (Langer et al., 2014) utilised a similar approach that mapped SDT and was provided by contextually trained nurses. Equally, the Green Prescription (Elley et al., 2003) in New Zealand was provided by those trained in brief MI and exercise. Thus, a contextually trained physiotherapist who is also skilled in SDT and MI should deliver the additional intervention in similar future studies.

6.12 Implications for future research

Both qualitative and quantitative analysis showed a trend toward efficacy but a further more comprehensive research study is needed because, by definition, this small feasibility study did not examine the intervention's effectiveness. Age would not form a suitable method of efficiently targeting participants and therefore a suitable outcome measure is required that enabled the identification of any improvements. Included data suggested that TUG was not completed at the exit point, but informal post hoc discussions revealed that this was not the case. Missing TUG data resulted from chance, and a more extensive study would ensure the inclusion of this vital source of data. With reflection, the assessment is quick to perform,

and KA should have captured the data. Therefore, future studies should consider this challenge.

6.13 Conclusions

This feasibility study successfully explored how OPREE influences attendance at an NHS strength and balance exercise programme. Directly resulting from OPREE, attendance increased to a clinically significant level. OPREE's perceptually useful components were information giving, signposting, regular prompts and motivation to attend the SBE programme.

BREQ3 data highlighted influential factors that affect exercise engagement where, suggesting a trend toward efficacy, participant's motivation to exercise for external reasons underwent a large improvement. Participant's adherence to exercise classes for a perceived obligation also underwent a medium improvement, further suggesting a trend toward efficacy. Of high interest, participants continued to exercise for an identified reason. No association between age and attendance was evident. Data paradoxically highlighted a frustration in relation to deteriorating physical health, but that mental health improved. The implication of this would be that OPREE improved mental resilience to physical deterioration. Equally, informal data highlighted that the two participants who withdrew, did so because of mental health challenges.

The process evaluation demonstrated that a more extensive future study would be acceptable. However, the informed, trusted, attentive, supportive and flexible professional also formed an essential component. While statistical significance testing was inappropriate, the findings from this thesis suggest that a more extensive and sufficiently powered trial should examine the intervention's effectiveness. Exit interviews also examined whether OPREE was acceptable to participants, and these suggested its acceptability and perceived usefulness with the potential to promote older people's rehabilitative exercise engagement.

Chapter seven discusses the entire thesis in relation to the literature and forms conclusions for future studies.

Chapter 7: Discussion

7.1 Summary

This Chapter summarises the findings and the implications of the results of this thesis. Conclusions are stated and further areas of work proposed.

7.2 Introduction

In 1947, the British Medical Journal published an article that asserted the danger of going to bed because of illness and the benefits of maintaining some level of physical activity despite physical disorders:

"Teach us to live that we may dread unnecessary time in bed. Get people up, and we may save our patients from an early grave."

(Asher, 1947) (p 968).

Many years later, the physical, psychological and social benefits of healthy and active lifestyles have been well established with consensual international physical activity recommendations (Department of Health, 2011d, Garber et al., 2011). As an example, a recent meta-analysis (Panza et al., 2018) suggested that exercise training may delay the decline in cognitive function that occurs in individuals who are at risk of or have Alzheimer's disease. Aerobic exercise potentially held the most favourable

effect. Additionally, an impressive body of research has also provided convincing evidence for the pivotal role of health-related behaviours in the improvement of well-being, morbidity, mortality and healthcare costs (Schroeder, 2007). Further, a longitudinal study (n = 7,731; age ≥ 50 years) identified low health literacy and high social isolation as risk factors for mortality (Smith et al., 2017). Therefore, by promoting physical activities, both physical and mental health can improve alongside the reduction of social isolation (Spirduso et al., 2005).

Despite many healthcare technological breakthroughs though, human actions remain the most significant source of variance in health-related outcomes. Therefore, to improve both the quality and length of people's lives, the adoption and maintenance of healthy behaviours is crucial (Patrick and Williams, 2012). While adherence to a medium to long-term exercise programme has long been known to improve arthritic pain and disability (O'Reilly et al., 1999), short-term pain levels increase during exercise performance and for a short period afterwards, and this often reduces adherence levels. Nevertheless, successful clinical outcomes demand adherence; *the act or quality of sticking to something* (Ireland, 2003). The World Health Organisation defined adherence as:

"The extent to which a person's behaviour corresponds with agreed recommendations from a healthcare provider"

(World Health Organisation, 2003).

In their seminal paper though, Sluijs and colleagues reported that 22% of patients were non-compliant, with 41% being partially compliant with exercise programmes (Sluijs et al., 1993). Adherence therefore is *the most unpredictable, "least controllable variable"* (Groth and Wulf, 1995).

The studies within this thesis aimed to devise and evaluate the feasibility of delivering an intervention that could promote older peoples' exercise engagement. Specifically, an intervention which would target community-dwelling older people. Contextually, the patient participants within this work were at risk of sustaining a fall as assessed by NHS health professionals and had been referred for SBEs. Despite being a cost effective (Abu-Omar et al., 2017) means toward reducing older people's risk of falling, a cyclical reduced level of functional independence and physical activity often ensues because of a subsequent fear of sustaining further falls (Horne et al., 2014).

Adherence to such exercise programmes is often believed to be too challenging, and few older people engage in the necessary volume of moderate-to-vigorous intensity physical activity recommended in the classes that are needed to counteract the adverse effects of too much sitting (Dogra et al., 2017). The work in this thesis led to the development of an intervention that promoted engagement in these strength and balance exercises (SBE) and was called the Older People's Rehabilitative Exercise Engagement (OPREE).

This Chapter contains three main sections. A summary of the work involved in the development and feasibility testing of OPREE. After this, strategies and recommendations for future investigations are discussed. Finally, conclusions and recommendations are presented.

7.3 Overview of the main findings

Using multiple research methods and guided by the Medical Research Council's (MRC) Complex Interventions Framework (Medical Research Council, 2008), the research presented in this thesis developed an intervention to improve older peoples' rehabilitative exercise engagement (OPREE). The investigation met the objective of systematically developing the OPREE intervention using the stages briefly described below.

Preparatory work formed the first stage with the identification of a clinical problem where approximately 50% of those patients referred to a highly evidence-based SBEs programme completed it. The localised quantitative data meant that the reasons remained mostly unclear (Chapter one). The findings from this Chapter emphasised that suboptimal class attendance could potentially be accounted for by differences between the opinions held by older people and those of clinicians. The second stage involved the use of the findings from a scoping review (Chapter two) to identify the theoretical base in guiding OPREEs' development. This Chapter identified

the OPREE's theoretical underpinning as Self Determination Theory (SDT), where exercise engagement could improve by supporting the fulfilment of the basic psychological needs of autonomy, competence, and relatedness (Deci and Ryan, 2002). The scoping review also confirmed that membership of a long-term cohesive group supported exercise engagement and that physical activity could be normalised into daily lives through appropriate signposting (Langer et al., 2014). A systematic review of potential interventions (Chapter three) for the promotion of rehabilitative exercise engagement identified a small number of relevant studies which covered participants with a wide range of physical health limitations. The findings suggested the use of a combined strategy to increase exercise engagement was needed which were appropriate to the context and person. This was a mixture of regular monitoring, feedback, motivational interviewing, positive messaging, and signposting people to appropriate services.

Before using the published data to develop the OPREE intervention it was important to get patients views. Consequently, the next stage was to contextualise the reasons why older people fully adhered, partially adhered or abandoned exercise performance through 12 patient respondent interviews (Chapter four). Additionally, these patient interviews and two interviews and a focus group with NHS members of staff explored the relevant, acceptable and useful interventions that might promote exercise engagement within the context of the existing strength and balance exercise programme. The data provided evidence that many older people's

exercise engagement levels were influenced by long-standing ingrained values, such as walking to an allotment as a child which then led to an enjoyment of hill walking, but also age-related factors such as joint pain, which led to a reduction in hill walking. Additionally, respondents advocated face to face sessions for an engagement intervention, over a prolonged period, that enabled in-depth explorations of the reasons for potential disengagement. The interviews also recommended that the engagement intervention needed to be delivered by an experienced healthcare professional.

The next stage of this thesis was to synthesise findings from the scoping review, the systematic review, and the interviews and focus group, to develop a theoretically driven intervention based on best available evidence (Chapter five). A combination of the MRC's framework for the development and evaluation of complex interventions (Medical Research Council, 2008) and the Template for Intervention Description and Replication (Hoffmann et al., 2014) formed a framework for describing the OPREE intervention. OPREE's components were identified as prolonged support and feedback, delivered by a knowledgeable professional through four face to face sessions delivered in the patient's own home. As outlined in Chapter five, it included behaviour regulation, MI (Miller and Rollnick, 1991), Needs Supportive Communication activities (Deci and Ryan, 2002b, Ntoumanis et al., 2018), and signposting (Kerse et al., 2005, Langer et al., 2014)

The fourth step was to assess the feasibility of delivering the OPREE intervention, and assess its acceptability and tolerability in older people. Additionally, to determine if there was any evidence of it achieving the intended results. A pre and post cohort study demonstrated the viability, acceptability and tolerability of delivering OPREE in an NHS community setting (Chapter six). Additionally, the results demonstrated that a NHS healthcare professional with additional training could provide the OPREE intervention. SBE classes were delivered over 20 weeks. Those participants in the control group (exercise class attendance only) had a median attendance of 45%. By contrast, the intervention group participants (exercise class attendance and receipt of OPREE), had a median class attendance of 75%. A survey of healthcare providers found that most believed the difference in between exercise engagement in people who had experienced OPREE and those who had not, to represent a clinically significant increase in exercise class attendance. Using Cohen's *d* effect size conventions (Bowling, 2014), and apart from integrated regulation all BREQ3 domains improved. Amotivation and extrinsic regulation underwent a large improvement. Levels of introjection reduced moderately. Intrinsic regulation improved slightly, but perhaps the most interesting change was that of identified regulation. These findings suggested that participants improved their exercise engagement, but continued to exercise for an identified reason, which was most often the maintenance of independence. Participants identified OPREE to be highly acceptable and useful in the exit interviews. Table 18 depicts the key findings from each Chapter.

Table 17: Thesis key findings

Chapter	Description	Purpose and key findings
One	Preface	• Portrayed the thesis setting, outlined the thesis structure, aims and questions. • Highlighted disparities between the opinions held by older people and those of clinicians which partially accounted for suboptimal class attendance.
Two	Scoping review	• Introduced an increasingly ageing and complex population that need to exercise to maintain their independence. • Identified the thesis' theoretical underpinning as Self Determination Theory, and that exercise engagement improves by fulfilling the basic psychological needs of autonomy, competence, and relatedness (Deci and Ryan, 2002b). • Recognised that membership of a long-term cohesive group supports exercise engagement. • Acknowledged the motivational potential for appropriate signposting to facilitate the normalisation of physical activity into daily lives (Langer et al., 2014).
Three	Systematic Review	• Aimed to identify useful physical exercise engagement strategies. • Results recommend an approach that combined positive messaging with Brief Motivational Interviewing, appropriate signposting, and continued support and feedback.

Chapter	Description	Purpose and key findings
Four	Interviews and Focus Group	• Built upon the systematic review findings with the aim of contextualising exercise engagement and those types of acceptable and potentially useful services. • Suggested that older people engage in exercise with the purpose of maintaining physical, psychological, and social independence despite various health conditions. • Findings supported the acceptability of continued personalised feedback, home visits, and appropriate signposting.
Five	Formation of OPREE	• Synthesised previous work to develop OPREE. • Described OPREE intervention, utilising TIDieR (Hoffmann et al., 2014), CONSORT (Schulz et al., 2010), and the Medical Research Council's framework for developing and evaluating complex interventions (Medical Research Council, 2000, Medical Research Council, 2008). • Identified OPREE's components as prolonged support delivered by a knowledgeable professional through face to face sessions that involved MI

Chapter	Description	Purpose and key findings
		(Miller and Rollnick, 1991), Needs Supportive Communication (Deci and Ryan, 2002b, Ntoumanis et al., 2018), and appropriate signposting (Kerse et al., 2005, Langer et al., 2014).
Six	Feasibility study	• Completed a feasibility study that, in addition to attending exercise classes, explored how OPREE worked over four, monthly, home-based sessions to eight female participants (age range 65 to 93 years). • Useful components were found to be information giving, signposting, regular prompts and motivation to attend the SBE programme. • OPREE could be delivered by an NHS healthcare professional with minimal training • Intervention acceptability was enhanced because the provider was an informed, trusted, attentive, supportive and flexible professional. • Case control median SBE attendance was 45%. OPREE median attendance was 75%. • A survey of ten healthcare providers (20% of 49 clinical researchers) found that 70% believed the difference between case control and OPREE to represent a clinically significant increase in exercise class attendance.

Chapter	Description	Purpose and key findings
		• BREQ3 domains all underwent change apart from integrated regulation. Using Cohen's *d* conventions: amotivation and extrinsic underwent a large improvement. Introjection underwent a medium improvement. Identified and intrinsic regulation underwent a small improvement. • SF12 domains all underwent change. Physical function and bodily pain deteriorated and therefore were not improved by OPREE. Role physical, general health, vitality, social functioning, role emotional, and mental health all improved by OPREE. However, the small sample size requires caution when interpreting these findings. • NEADLS score improved from 17.15 out of 22 at baseline to 19.00 post intervention. This suggested an improvement, but also a ceiling effect. • Power calculation (91%) demonstrated that an RCT that recruits ≥ 50 participants could test OPREE's effectiveness and reduce the risk of Type I or II errors to < 1.5% while accounting for 20% attrition.

7.4 Strengths and limitations

Individual Chapters discussed their particular strengths and limitations. One strength of the thesis was that the views of older people and healthcare providers enabled the derivation of the study and the OPREE intervention through interviewing NHS patients and members of staff. Additionally, the study methods and findings were regularly discussed between the student (KA) and a team of supervisors who were experts in geriatric medical care, rehabilitation of older people, health psychology, and social science. This thesis, though, has an over-arching double-edged factor in that a highly experienced physiotherapist, specialised in community rehabilitation of the older person, conceptualised, developed, delivered, and evaluated OPREE as an intervention. On one hand, this is a strength in that the topic is of most relevance to physiotherapists, therefore it should be these professionals who evaluate their own clinical practices. On the other hand it is also a limitation as a physiotherapist might have introduced bias when evaluating physiotherapy interventions. To moderate this possible bias, a highly experienced team of supervisors rigorously assessed the thesis from a health psychology, social science, medical and therapeutic stance. Additionally, over a four-year period, KA underwent extensive research training that emphasised the need to address and reduce the risk of such biases.

A strength is that the MRC framework (Medical Research Council, 2008) guided OPREE's development which followed a logical approach with each

component supporting the next stage of development. While the MRC framework acknowledged various areas for consideration during the development of OPREE, methodological guidance was, however, scarce. Thus while each components' employed methods that were suitable, the potential for omission of some areas remained. For example, the systematic review was set in the context of improving attendance at an SBE class but only identified eight relevant studies. Had the search terms included 'physical activity', the review might have added a more significant number of appropriate studies.

A perceived limitation of the recruitment process for the feasibility study was that the majority of patient participants were female (11 of 12 interview respondents, and all study participants). However the sample was typical of those entering into the exercise programme (83% female) so results could be generalised to other mainly female populations. The reasons for low male referral rates to the SBE programme remain unanswered; however, the published literature suggests that men exercise for the challenge, but women for the maintenance of health and social connections (Gurung, 2010, Chamorro-Premuzic, 2015, Hagger and Chatzisarantis, 2005). In addition, research suggesting that older women require higher levels of support (Orsega-Smith et al., 2012) and are thus, less likely to exercise than men (Woo et al., 2006). This finding may indicate that it is possible that men need less help in their continuation of exercise programmes. One recommendation from this thesis is that future studies

should attempt to increase the number of male participants to improve OPREE's generalisability.

Another potential limitation, was that some feasibility study participants were potentially altruistically motivated to continue with the OPREE intervention and the SBE programme because of a sense of obligation to KA, the primary researcher. This factor is not uncommon and noted elsewhere (Sandford et al., 2017). Nonetheless, the counter argument might suggest that participants responded to a personalised, targeted intervention from a health care professional and this would need to be included in any future studies. A randomised controlled trial that investigated return to work in patients with chronic musculoskeletal pain supported the use of a multidisciplinary face to face intervention in hastening an optimal level of function (Brendbekken et al., 2017).

A limitation was that OPREE was only tested in one NHS SBE programme. However, the SBE programme is based on the evidence based Later Life Training programme (Later Life Training, 2016) which is widely provided across the NHS. Therefore it is very possible that it could be used in all NHS provided exercise situations for older people. This finding requires further testing in different health and social care domains. Additional testing in multiple domains would enable the identification of the mediators and moderators in the improvement of exercise behaviour regulation (Patrick and Williams, 2012).

7.5 Relevance to other literature

The use of theory is necessary in the informing and testing of interventions (Michie et al., 2014) because it expands basic science, and ensures the *real world* practical utility of developed interventions (Patrick and Williams, 2012).

Utilising DeMaria's (2012) categorisation, adherence to exercise can be full (attending classes with maximal exercise performance), partial (attending classes with minimal exercise performance), or even unintentionally absent because of forgetfulness or illness. While classes can improve adherence to prescribed exercises (Picorelli et al., 2014) and are cost-effective (Abu-Omar et al., 2017), data identified suboptimal attendance rates. One finding from this thesis suggested that health professionals often expected patients to adhere to their advice, but did not understand barriers in the form of personal values, attitudes and beliefs. Related studies support this where, in the context of cardiac disease sustained adherence to medications and lifestyle modification adherence varies (DeMaria, 2012). In the present thesis, study data highlighted that several respondents or participants withdrew from the exercise programme because of physical illness or pain. This finding correlated with other studies that indicated physical activity participation to negatively correlate with severe arthritis (Stubbs et al., 2015) which is a very painful condition. Separate research also identified the need to improve participants' beliefs in their ability to autonomously manage ongoing symptoms (Williams and French, 2011), and that a more

extended intervention is ineffective unless it is supported by a theoretically underpinned behaviour change strategy (Hay-Smith et al., 2016, Kunstler et al., 2017).

As an example, a systematic review (n = 11 studies) that was completed at the same time as this thesis, aimed to assess the effectiveness of interventions used to improve exercise adherence in older people, and evaluate them (Room et al., 2017). The researchers aligned their analysis with the theoretically underpinned Behaviour Change Technique Taxonomy (Michie et al., 2013a): comparison of behaviour, feedback and monitoring, social support, natural consequences, identity, goals and planning, and behavioural theories. Of the 11 included studies, four reported a positive adherence outcome following their intervention. Three of these interventions were categorised in the feedback and monitoring category. Four studies used behavioural approaches within their study. These were social learning theory, socioemotional selectivity theory, cognitive behavioural therapy and self-efficacy. Seven studies did not report a behavioural approach. Interventions in the feedback and monitoring category showed positive outcomes. This result supports the OPREE intervention's use of the Self Determination Theory.

The systematic review in this thesis only found eight eligible studies, but it may be that a wider search, which included other populations would have highlighted investigations that have examined adherence to therapeutic exercise which could have influenced the development of the OPREE

intervention. One review (Ezzat et al., 2015) assessed the effectiveness of interventions, with the goal of improving exercise adherence in people with the age related condition of arthritis. From the 22 eligible articles, nine revealed a statistically beneficial effect of the intervention on adherence. The researchers thus concluded that there was limited evidence that interventions can improve exercise adherence in the presence of osteoarthritis. However, adherence was often a secondary outcome, sample size calculations were rarely provided, and studies may have been underpowered to detect a difference between the intervention and the control for this outcome. Nonetheless, these findings highlight the difficulties associated with improving adherence in the presence of painful age related conditions.

Continuing this, Nicholson and colleagues conducted a systematic review and meta-analysis in the evaluation of interventions aimed at increasing adherence to therapeutic exercise for older adults with chronic low back pain and/or hip/knee osteoarthritis (Nicolson et al., 2017). They identified 3,899 studies but only nine studies with 1,045 participants were eligible. Behavioural counselling, action coping plans and/or audio/video exercise cues did not improve adherence significantly. The researchers concluded that continued monitoring and feedback were useful methods of improving adherence to exercise. However, Peek and colleagues conducted a systematic review of the interventions used to aid patient adherence to all physiotherapist prescribed self-management strategies (Peek et al., 2016).

The researchers found that potential adherence aiding interventions included a behavioural exercise programme with booster sessions and goal setting. Although several interventional studies positively influenced patient exercise adherence, they also asserted that, there was insufficient data to endorse their use in clinical practice. Their findings highlighted a research gap, but also suggested that exercise adherence could be promoted through a tailored combination of approaches. This finding was further supported in the context of adherence to musculoskeletal outpatient clinic based therapeutic recommendations, which suggested the benefits of a motivational cognitive behavioural programme, but not in the long term (McLean et al., 2010).

7.6 Recommendations for future research

Older people face unique physical, cognitive and social challenges that have a strong impact on their quality of life which, consequently, could be as important as morbidity and mortality measures (Rajan et al., 2012, Welmer et al., 2017, Martinez-Martin et al., 2012). Study findings suggest that interventions designed for younger adults might not be as useful for older people (Notthoff and Carstensen, 2014a, French et al., 2014a). Despite such suggestions, relevant, high-quality intervention research is limited and an international Delphi consensus statement highlighted the need to reverse the shortage of studies that investigate approaches of improving older peoples' physical activity levels (Dogra et al., 2017). This thesis has, in part, informed the means of maintaining older peoples' functional

autonomy through exercise engagement (Copeland et al., 2017), but studies need to promote healthy ageing across the different stages of the life course (Public Health England, 2017). It remains entirely possible that any community-based exercise class designed to improve health in older people could be enhanced by the addition of an engagement strategy such as OPREE, but in times of continued economic austerity and significantly reduced local government public health budgets, immediate potential barriers are evident in the initiation of OPREE (Oliver D., 2016). Therefore, in the formation of research recommendations, three questions were considered: what was the optimal modality of delivery in the value driven context of a 21st Century health and social care setting, what outcome measures are most appropriate, and which research methodology would best measure OPREE's effectiveness?

7.6.1 Modality of OPREE delivery for future studies

The systematic narrative review and the interviews and focus group determined OPREE's components that the feasibility study then reported to be acceptable and perceptually useful. Arguably, the naturalistic face to face delivery of Needs Supportive Communication Strategy was more preferable because telephone or electronic sessions potentially represented a *need thwarting style* (Deci and Ryan, 2000) with the possibility for long-term exercise disengagement. In other words, face to face sessions allowed for more open and honest discussions about how participants' could have

their needs supported. Telephone sessions would not facilitate the meeting of their needs. OPREE's delivery was nonetheless, often challenged not by the individual participant's motivation but by different physical and mental health challenges, and a high degree of tailoring of the intervention was required.

This finding correlated with a previous Delphi consensual statement that advocated tailored health education that promotes a positive identity and identifies with the individual's values in the improvement of adherence to SBE programmes (Yardley et al., 2007). Commissioners of services demand evidence of the benefits of new care models (King's Fund, 2017a) that radically upgrade research into preventative interventions (Council of Deans of Health, 2017). The outcome of such studies should be to develop demonstrably safe and clinically effective interventions that incorporate measures of patient experience (Department of Health, 2013). A systematic review of 55 studies showed that interventions that incorporate patient experience measures increased adherence and improved self-rated and objectively measured health outcomes to services (Doyle et al., 2013). As examples, both the Green Prescription (Elley et al., 2003, Kerse et al., 2005, Ministry of Health, 2016) and the approach to chronic disease medication adherence (Langer et al., 2014) encompassed the concept of social exercises. A promising and emerging approach is that of the Needs Supportive Communication Strategy (Ntoumanis et al., 2018) alongside appropriate signposting to resources more able to provide support in the

longer term (Elley et al., 2003, Langer et al., 2014). Nonetheless, if the arguably uninnovative, concept of signposting is to succeed, robust systematic and objective evaluative evidence from interventional studies, is required because it is currently reliant on self-reported outcomes. As such, strong partnerships between local government, the NHS and other organisations working in population health systems are required (King's Fund, 2017a). Gemma, one staff interview respondent was sceptical however because she perceived that *"personalities"* are unable or willing to drive change forward in the absence of such widely accepted empirical evidence.

The results of this thesis suggest that more research is needed to explore the use of theoretically underpinned behaviour change strategies that are specific to supporting older people's exercise engagement, and a systematic review (French et al., 2014a) supported this by demonstrating the need for more age-specific research, which also categorises older peoples' precise requirements of physical activity interventions. One potential and unique strategy for this specific population is the socio-emotive strategy where older people recognised and more optimistically interpreted positively framed, rather than negatively framed messages, and this correlated with an increased motivation to participate in physical activity programmes (Notthoff et al., 2016). The researchers advanced that, generally older people might not be interested in the physical benefits of physical activities, rather, benefits such as the opportunity to participate in enjoyable and

sociable activities. The obvious result here then, is that exercise groups need to ensure the promotion of these components, but the obvious next question is more about the definition of 'enjoyable and sociable'.

To understand those activities, the given person's needs and ingrained cultural values require attention, and studies determined that, when they did not support participant autonomy or perceived needs (Duda et al., 2014), long-term exercise referral schemes were found to be ineffective (Isaacs et al., 2007). In other words, a behaviour change strategy is essential because simply providing more of the same exercises is ineffectual, and future studies need to ensure the incorporation of a behaviour change strategy (National Institute for Health and Care Excellence, 2014b). Accordingly, it is recommended that future more extensive investigations utilise MI, NSCS, and signposting during naturalistic face to face sessions that extend the length of the exercise classes. Additionally, it is recognised that exercise engagement can only be truly judged successful when measured in the long term; a one year review is recommended.

7.6.2 Measuring value in future studies

The concept of 'value' represents a development from the quality improvement of healthcare services and includes elements that add to the sustainability of services (Porter, 2008). Value forms the product of clinical

effectiveness and patient experience, divided by the cost of providing the new intervention (Tolan, 2016) but a survey (n = 184) demonstrated that 55% of therapists consider clinical effectiveness, not quality, to represent a satisfactory service (Tolan, 2016). Future studies of the OPREE intervention will therefore need to assess participants' health-related quality of life (HRQoL); a calculation of how a disease, disability, or disorder affects wellbeing and its impact on adherence.

This suggestion would implicate a cost utility or cost-effectiveness analysis, a type of financial analysis that estimates the ratio between the cost of OPREE and the benefit it produces (number of years lived in full health). A cost-effectiveness analysis reaches beyond a cost-benefit analysis that systematically estimates the strengths and weaknesses of alternatives (Brazier et al., 2017). Generally, those interventions costing less than £20,000 per Quality Adjusted Life Year (QALY) gained are considered to be cost effective (National Institute for Health and Care Excellence, 2013b). The calculation of the QALY can be achieved through various tools. For example, the Manchester Short Assessment of Quality of Life is a brief instrument for assessing quality of life in psychiatric populations and has been shown to have satisfactory psychometric properties (Priebe et al., 1999), but was not appropriate for OPREE because of its focus on mental health. However, data demonstrated potential mental health improvements over physical function, therefore the tool might be more appropriate than a Quality Adjusted Life Year assessment within the older population because of reduced sensitivity to change within frailer older people. The Barthel

Index might have been appropriate because it uses ten variables in describing Activities of Daily Living and mobility but has been shown to have a ceiling effect (Sarker et al., 2012).

Additionally, when combined with time, EuroQol 5D (EQ5D) is a standardised tool (Brazier et al., 2017) that forms two components, description and evaluation of health state and measures five generic health status domains (mobility, usual activities, self-care, anxiety/depression and pain/discomfort). The tool has been validated in conditions such as chronic pain (Vartiainen et al., 2017), stable angina (Wu et al., 2014), and cognitive impairment (Ankri et al., 2003, Karlawish et al., 2008). Therefore, it is recommended that future and more extensive investigations utilise EQ5D as a cost utility analytic tool to inform commissioners of services.

7.6.3 Appropriate outcome measures for future studies

In developing and testing interventions that aim to improve health behaviours such as nutrition or physical activity, increasing emphasis obligates the use of theory (National Institute for health and Care Excellence, 2014a). Additionally, in their systematic review of interventions that promote adherence to therapeutic exercise, Room and colleagues assert the need to develop robust, valid and reliable adherence measures (Room et al., 2017). To pursue the argument for highly personalised interventions appropriate outcome measures are needed to target specific

domains; this represented a challenge in this thesis. As an example, an increased fear of sustaining injurious falls potentially instigates a spiral of decline where reduced functional abilities (Lord et al., 2007) increases the risk of social isolation (Holt-Lunstad et al., 2015). While the Timed Up and Go test has limited ability to predict falls in community dwelling elderly (Barry et al., 2014) it is a useful predictor of functional mobility (Podsiadlo and Richardson, 1991). Therefore a question could be proposed: should future and more extensive investigations of OPREE use an outcome measure that focusses on physical, psychological or social function?

Within the context of stroke, the Nottingham Extended Activities of Daily Living Scale (NEADLS) was chosen because it was suggested to be symmetrical, concurrently valid with no floor and ceiling effects, and corresponded well with other tools (Sarker et al., 2012). OPREE was, however, set in the context of a falls preventative SBE programme provided for community dwelling older people, and participant data suggested a ceiling effect that future and more extensive studies might accentuate. Equally, the survey did not allow for explanatory variables. As an example, when identifying the ability to maintain the garden as an indicator of functional capabilities, the tool did not account for those who lived in a flat (n = 2) or living with family members who like to garden (n = 4). Further, commensurate with the difficulties of therapeutic trials, it is unclear whether OPREE enabled any change, or change resulted from exercise class attendance.

As discussed in Chapter five, the Short Form 12 (SF12) was able to demonstrate that while OPREE did not improve physical functioning domains, it could potentially, improve various mental health domains including depression levels, with a consequential increase in exercise adherence. Exercise related behavioural regulation is not dichotomous, rather, it forms a continuum. At one level, the benefits and values of exercise are imperceptible, and at the other, they are integrated into one's lifestyle (Deci and Ryan, 2002b). BREQ3 formed the feasibility studies secondary outcome measure enabled an understanding of influential factors that account for such deregulation or full lifestyle integration. Importantly, the survey served as both a study outcome measure and an interventional tool; it allowed the identification of domains that the treatment sessions needed to address. Hence, researchers and clinicians need to assess participant behavioural regulations to understand the *active ingredient* (Medical Research Council, 2000) to ensure accurate interventional targeting. Additionally, because they would most likely represent those most in need (Tudor-Hart, 1971), future studies should consider targeting the recruitment of those who are reluctant to engage in such interventional rehabilitation research (Gitlin et al., 1995). Potentially, BREQ3 might form a means of identifying such participants; this too would require more extensive testing.

The recommendation therefore is that future studies utilise SF12 as a means of identifying physical and mental health changes and OPREE's

'active ingredient' (Medical Research Council, 2000). The tool is copyrighted, requires access to appropriate software, and therefore, would need to be budgeted for during the design of more extensive trials. Additionally, BREQ3 should be investigated for its potential use as a tool to identify those at risk of sub-optimal exercise engagement. This recommendation embraces strategic drives to immerse rehabilitative exercise programmes with different health and social care interventions that require long-term perseverance.

7.6.4 Future studies methodology

A systematic review of 19 reviews that spanned a period of 25 years, yielded 1,284 studies, and demonstrated the potential for multi-modal and multi-component interventions to be effective at improving community dwelling older peoples' physical activity levels (Zubala et al., 2017), but the included interventional studies were heterogeneous with a high risk of bias. Therefore, the precise effect magnitude was difficult to calculate. This finding was especially so with those studies extending beyond 12 months. This finding reinforces a new five-step international Delphi consensus process that identified the need for research in promoting adherence to exercise programmes (Dogra et al., 2017). Notably, the modelling phase of this thesis completion coincided with the publication of the 'Six steps in quality intervention development (6SQuID)' (Wight et al., 2016) (table 19).

Wight and colleagues focused on public health interventions; this thesis has successfully mirrored the first five steps, and future work will address the final stage.

Table 19: 6SQuID

Step	Activity
1.	Define and understand the problem and its causes.
2.	Clarify which causal or contextual factors are malleable and have the most significant scope for change.
3.	Identify how to bring about change: the change mechanism
4.	Identify how to deliver the change mechanism
5.	Test and refine on a small scale
6.	Collect sufficient evidence of effectiveness to justify rigorous evaluation/implementation

Separately, a growing methodological field emerged during the formation of this thesis in that of realist evaluation, and recently published guidance enabled the application of realist principles in alignment with the Medical Research Council framework (Fletcher et al., 2016). Potentially, a realist review might have further guided the development of OPREE but may have limited the involved quantitative and qualitative detail. Nevertheless, the adoption of reporting frameworks, such as Consensus on Exercise Reporting Template (Slade et al., 2016) and TIDieR (Hoffmann et al., 2014) might allow the use of a future realist review. As a multifaceted intervention,

various evaluative methods exist. Table 20 summarised these (Craig et al., 2008) and demonstrated that preference trials, randomised consent designs or N-of-1 designs were inappropriate to OPREE's further evaluation.

Therefore, three methods were considered: individually randomised trials, cluster randomised trials and stepped wedge designs. An individually randomised trial randomly allocates participants to receive either the new intervention usual care, a placebo or to await treatment. OPREE represents a complex intervention that aimed to increase adherence to interventional groups; such an approach was therefore inappropriate. The feasibility study in this thesis provided limited evidence of interventional effectiveness, and a randomised stepped wedge design would facilitate a Randomised Controlled Trial (RCT) with the minimisation of practical or ethical objections. The whole sample population would eventually receive the intervention as it is rolled out, but the OPREE's next phase would not result in the roll-out of the intervention because its effectiveness is, as yet unproven. Health service researchers often use cluster randomisation where randomisation occurs by group (experimental or usual care) rather than individuals.

Table 20: Summary of effectiveness trials

Trial type	Characteristics
Individually randomised trials.	Individuals are randomly allocated to receive either an experimental intervention or an alternative such as standard treatment, a placebo or remaining on a waiting list. While the basic method varies, such trials are sometimes dismissed as inappropriate for complex intervention studies. Nevertheless, inherent technical and ethical problems can be solved.
Cluster randomised trials.	Cluster randomisation is widely used in health services research because contamination of the control group potentially leads to biased estimates of effect size. Here, groups of older people undergoing various interventions are randomly allocated to the experimental or a control intervention.
Stepped wedge designs.	Randomised stepped wedge designs overcome practical or ethical objections to experimentally evaluating an intervention for which there is some evidence of effectiveness. Such designs allow a randomised controlled trial to be conducted, but the roll-out of the intervention is not delayed. Eventually, the whole population receives the intervention, but with randomisation built into the phasing of implementation.
Preference trials and randomised consent designs.	Non-standard designs sometimes overcome practical or ethical obstacles to randomisation. Where patients have firm preferences among treatments, basing treatment allocation on patients' preferences, or randomising patients before seeking consent, may be appropriate. All exit interview respondents reported OPREE to be highly acceptable with few preferential variations. Therefore this methodology was inappropriate.
N-of-1 designs:	N-of-1 trials, in which individuals undergo interventions with the order or scheduling decided at random, can be used to assess between and within-person change, and to investigate theoretically predicted mediators of that change. Together with semi-structured interviews, systematic review, and the feasibility study the change mediators have been investigated. Thus, this methodology was inappropriate.

Cluster randomisation is highly suited to health and social care interventions and avoids biased estimates of effect size because of contamination. Therefore, the recommendation is that future studies adopt a cluster RCT method.

During the design of a future, more robust RCT that would test the intervention's effectiveness, the sample size needed to be decided. The objective of a future trial would be to examine the intervention's effectiveness for increasing adherence to long-term health and social care programmes. Sufficiently powered studies reduce the risk of type I and II errors (respectively, false positive and negative results), and assuming an 80% power level with an alpha value of .05, the risk of such an error is 1.5% (Kirkwood and Sterne, 2003). Hosted by the Heinrich Heine Universitat, Dusseldorf, G Power (version 3.1.9.2), a freely available software application (http://www.gpower.hhu.de/en.html) enabled an a priori power calculation that utilised class attendance as the primary outcome measure. Table 21 detailed the output.

Table 21: Power calculation

```
t tests - Means: Difference between two independent means (two groups)
Analysis:       A priori: Compute required sample size
Input: Tail(s) =        One
        Effect size d   =       0.8571429
        α err prob      =       0.05
        Power (1-β err prob) =      0.8
        Allocation ratio N2/N1      =       1
Output:         Noncentrality parameter δ   =       2.5714287
        Critical t      =       1.6909243
        Df      =       34
        Sample size group 1 =       18
        Sample size group 2 =       18
        Total sample size   =       36
        Actual power    =       0.8091752

t tests - Means: Difference between two independent means (two groups)
Analysis:       A priori: Compute required sample size
Input: Tail(s) =        One
        Effect size d   =       0.8571429
        α err prob      =       0.05
        Power (1-β err prob) =      0.9
        Allocation ratio N2/N1      =       1
Output:         Noncentrality parameter δ   =       3.0304578
        Critical t      =       1.6772242
        Df      =       48
        Sample size group 1 =       25
        Sample size group 2 =       25
        Total sample size   =       50
        Actual power    =       0.9102756
```

Feasibility study data enabled the expectation of a clear directed result, and justified a one-tailed t-test with a more accurate power calculation that would avoid a type I or II error. A power of 80% to 90% is considered acceptable in most studies (Kirkwood and Sterne, 2003), but output only just exceeded the accepted threshold of 80% with a recommended total sample size of 36. Equally, trial data suggested a 20% attrition rate. The final potential sample size would be approximately 29 with the assumed attrition of 20%, and the power threshold was, thus reset to 90%. The revised power calculation exceeded accepted limits at 91%, which would

reduce the risk of type I or II errors to less than 1.5%, and account for 20% attrition. These findings reflected the difference between usual care and OPREE's attendance and supported the clinical significance of the outcome. A future study should recruit at least 50 participants, accordingly, a total sample of 60 participants would allow 30 in each section. The recommendation would be that a future study utilises two arms (table 22):

Table 202: Proposed RCT design

Study arm	Description
Intervention	An intervention similar to OPREE but with monthly sessions for the duration of the exercise programme.
Case control	Participants receive usual care only.

Future studies would also require inclusion of Excess Treatment Costs. NHS England has a mandate endorsed by the Secretary of State that specifically requires the payment of treatment costs for NHS patients taking part in newly commissioned government and research charity organisation funded studies that improve patient outcomes, but also contribute to economic growth (NHS England, 2015). In principal, there is no reason that OPREE could not be provided within the wider health and social setting. The recommendation is that future studies recruit from other healthcare packages that require long-term patient perseverance. Future conceptions of OPREE also require redirection to reduce the emphasis on exercise. Thus,

the final recommendation is a rebranding of OPREE to Helping Older People Engage with health and social care: HOPE.

7.7 Conclusion

This thesis has successfully developed and performed a feasibility study which suggests that OPREE can be successfully delivered. Initial results showed that OPREE might increase engagement with prescribed exercise but this needs rigorous testing in a cluster randomised controlled trial.

Eight of the ten patients who accepted the offer of OPREE completed it. Control group SBE mean attendance was nine sessions (45% attendance). Intervention participants attended a mean of 15 sessions (75% attendance). Seven of ten surveyed clinicians believed the difference was clinically significant. As participants started to identify with engaging with exercise behaviours, attitudes towards exercise behaviour in the intervention group changed from being unmotivated to exercise, to exercising for their own reasons and not because they felt pressured by others. Participant exit interviews highlighted that OPREE was considered acceptable and useful. Future studies should also consider a number of unanswered questions. For example: is OPREE appropriate for younger patients, why did some patients decline the offer of OPREE, and could this

intervention be delivered successfully by trained health care workers who are not registered professionals.

7.8 Personal position

The position of the researcher before this work was undertaken is described at the beginning of this thesis. By undertaking this work, my beliefs and attitudes to engaging older people in rehabilitation have changed, and the findings from this thesis have emphasised the need to influence different practices that facilitate engagement as opposed to expecting adherence. During the write up phase of this thesis, I have returned to NHS clinical practice, am disseminating the findings, and where appropriate, my research is having a positive influence on the provision of care for my patients.

Over the duration of my Doctoral studies, I have overcome several personal and academic hurdles; these have affected my dissemination plan. On commencement of my studies, I naively expected to be able to publish several papers that would disseminate the findings from each chapter; this was not to be so. Nevertheless, I have published a poster at an international conference and have iteratively influenced clinical practice throughout the three year programme. The current dissemination plan is to:

1. Publish one paper to a relevant journal about the development and testing of OPREE so that other services might change practice. Currently, one journal has declined the offer of publication and the draft is being reformed for another submission to a more appropriate journal.
2. Review, update and publish the systematic review with a second and third reviewer. The updated review will relate to current developments, while widening the scope of the review to include physical activities such as dancing.
3. Continue to disseminate the findings to clinicians to improve clinical practice. Specifically, to reduce the prevalence of providing information and expecting patients to comply.
4. Within the context of current financial restrictions, to influence the further development of a pragmatic version of OPREE.
5. Initiate discussions about collaborative work with other sectors to strengthen a research grant application for a co-produced cluster randomised trial.

It is anticipated that these works will take approximately two years to complete. The subsequent research study will last one year with a further year of write up; therefore, the output from this Doctoral project will not be fully realised for at least three years.

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Appendix A: Systematic Review protocol entry on PROSPERO

Strategies designed to increase older people's exercise engagement: a systematic review

Kevin Anthony, Veronika Van der Wardt, Tahir Masud, Kristian Pollock, Pip Logan

Citation

Kevin Anthony, Veronika Van der Wardt, Tahir Masud, Kristian Pollock, Pip Logan. Strategies designed to increase older people's exercise engagement: a systematic review. PROSPERO 2016 CRD42016030155 Available from: http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016030155

Review question

Which support strategies have a positive effect on engagement in exercise in older people?

The objective of this review is to identify and critically appraise those engagement strategies which are used alongside exercise and which have the purpose of increasing or improving adherence to exercise specific to older people.

Searches

To capture the breadth and type of possible sources, the following databases were searched: PubMed, MEDLINE, PsycINFO, EMBASE, and AMED. References lists from included studies will be reviewed and subjected to hand searching. Although not all available bibliographic databases have been chosen, included databases will ensure a multi-disciplinary which enables generalisation of the findings. Search terms: Health promotion OR behaviour change AND exercise OR rehabilitation AND intervention AND older* OR aged OR elderly. The same search terms will initially be used in all of the electronic databases; search terms will be manipulated according to the results of that phase. The term older has also been automatically exploded to retrieve citations that carry the specified Medical Subject Heading (MeSH) or subheading and also retrieve citations that carry any of the more specific MeSH headings (or subheadings) indented beneath it in the Tree structure. All other search terms will be 'focussed'. In 2007, Van Dulmen et al made note that adherence research had made slow progress over the preceding 30years (van Dulmen et al., 2007); articles will therefore be restricted from 1977 to February 2016. To capture the breadth and type of possible sources, the following databases will be searched: PubMed, Medline, Psychinfo, EMBase, and AMED. Only articles in English will be sourced, and duplicates will be removed. References lists from included studies will be reviewed and subjected to hand searching. Although not all available bibliographic databases have been chosen, included databases will ensure the range of strategies which enables generalisation of the findings.

Only articles in English were sourced, and duplicates were removed.

Types of study to be included

Controlled, cohort, cross sectional, case-control, case, and interview studies will be included.

Condition or domain being studied

Whilst many older people live independent, healthy, fulfilling lives, one challenge to such a healthy and independent life is that of inactivity. A consequence of an ageing population is that an increasing number of older people experience an extended period of chronic disabling illness and frailty which increases their risk of falls and associated injury. The evidence base for the protective effect of exercise is well established, as is the poor levels of engagement and adherence of older people to rehabilitative exercise. Whilst strength and balance exercise training programmes form a highly evidence based intervention in the reduction of falls risk, sub-optimal engagement levels are evident. Many reasons for this sub-optimal level have been theorised and might include sub-optimal self-efficacy, motivational or capability levels. The emphasis of this review is to investigate those preventative rather than curative interventions which aligns with the NHS's 5 year Forward View (NHS, 2014). Such preventative interventions encompass public health type strategies and there is an appetite for such interventions.

Several complex interacting domains impact upon healthy behaviours and many historical interventions have been atheoretical. A provisional review of the research suggests that behavioural change interventions need to be specific to person, culture, and behaviour.

Participants/population

Included studies are those where all participants were 65 years and over or where the mean and standard deviations indicated that the majority of participants were 65 years and over. There is no upper age limit. Whilst the focus of the review is that of exercise for the treatment of health conditions, all exercise interventions specifically for older people will be considered so that the range of interventions can be captured.

No specific country will be identified but only those studies involving community dwelling participants will be included.

Only studies which involve humans will be eligible.

Intervention(s), exposure(s)

The focus of this review is the identification of effective engagement strategies for those older people who live in the community. Studies which include physical rehabilitation and / or exercise interventions provided as a treatment for a medical condition where an engagement strategy has been

reported will be included. Those studies which largely focus upon physical rehabilitation but which incorporate mental health components (for example, fear of falling) will be included.

Conversely, studies which clearly focus upon mental health (for example, depression) rather than physical health were excluded. Excluded studies were also those that only report an exercise intervention but not an engagement strategy, reported predictive factors, or combined exercise with other behavioural interventions (for example, diet). This criterion was applied because the purpose of this review is to facilitate identification of the 'active ingredient'. Critical or systematic reviews were excluded.

Comparator(s)/control

There are no comparators

Primary outcome(s)

The primary outcome is the level of long term exercise adherence.

Timing and effect measures

The term 'long term' has various definitions and is therefore not specified within this study; rather, studies will be accepted where the emphasis is that of long term.

Secondary outcome(s)

None

Data extraction (selection and coding)

All studies identified in the search were screened for eligibility using title and abstract by the primary reviewer (KA), with duplicates and ineligible studies removed. Full text versions of the remaining studies were then further assessed for eligibility by the primary reviewer. Once the full text was read by the primary reviewer, a second reviewer will independently assess eligibility of the full text studies classified as suitable for inclusion. Of those full articles retrieved but deemed to be unsuitable for inclusion, the second reviewer will also perform a 10% audit by a review of the data capture sheet. Where disagreement occurs, a third reviewer will adjudicate.

Risk of bias (quality) assessment

Quality assessment results from both the CASP and MMAT tools will be presented. Overall quality score for both tools will be calculated and supplemented with a narrative assessment (Shadish et al., 2001). To ensure a coherent understanding of study quality, scores will be recorded thus: yes responses gain 2 marks, unsure responses gain 1 mark, and negative responses gain 0 marks. Mean score will then be presented as a

percentage of the total possible score and then assessed to be poor (=50%), moderate (=80%) or good (=100%) quality (McGill, 2011).

Strategy for data synthesis

The analytic methodology of choice will be dictated by the results. For example, if appropriate, a meta-analysis will be performed. Where heterogeneity of research methodologies is evident however, such an approach will not be appropriate. In this case, thematic or narrative analysis may be performed. Where data is provided within the article, adherence rates will be described. Engagement strategies will be described using frequencies and percentages if possible. Findings will be summarised in tabular format, categorised by engagement strategy type.

Analysis of subgroups or subsets

None planned

Contact details for further information

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Organisational affiliation of the review: University of Nottingham

Review team members and their organisational affiliations

Mr Kevin Anthony. University of Nottingham

Dr Veronika Van der Wardt.

Professor Tahir Masud.

Dr Kristian Pollock.

Professor Pip Logan.

Anticipated or actual start date

02 November 2015

Anticipated completion date

29 February 2016

Funding sources/sponsors

Collaboration for Leadership in Applied Health Research and Care East Midlands

University of Nottingham

Nottingham CityCare Partnership CIC

Conflicts of interest

None known

Subject index terms

Aged; Exercise; Humans

Date of registration in PROSPERO

14 January 2016

Date of publication of this version

16 January 2016

Appendix B: Systematic Review Data Extraction Sheet

Noyes & Lewin (Noyes and Lewin, 2011) and The Cochrane Group (The Cochrane Public Health Group, 2011)

Lead author name	
Title	
Reference	
Geographical setting (country, rural, city?)	

Screening (if any answers are no – check for inclusion eligibility)

	Yes	No	Unclear
Study participants are 'older people'?			
Study is set within the community?			
Study focus is on physical rehabilitation?			
Study is interventional?			
Study primary focus is adherence?			
Brief comment ref nature of study:			

Methodology

	Please state		
Study type?			
Intervention set in background of which healthcare condition (COPD, Falls, CHF etc.)			
Study aims / purpose? Clearly stated?			
Type, content, and length of intervention List strategies used			
Data collection points Duration of follow up (appropriate?).			
Method of intervention delivery (group, face to face, postal, telephone, DVD etc.)			
Ethical approval obtained?	Yes	No	Unclear
Informed consent obtained?	Yes	No	Unclear

Ethical issues addressed adequately? Confidentiality maintained?	Yes No Unclear Yes No Unclear

Sampling

	Please state
Number of participants Appropriate sample size? Participants likely to be representative of target population?	Intervention n= Control n= Other (state) n= Yes No Unclear Yes No Unclear
Participants age range (mean & SD)	
Participants gender Socio-Economic Status reported (details)	Male n= Female n= Gender not reported (reason why)
Rationale and appropriate choice? Sufficient detail about the setting?	
Inclusion criteria	
Exclusion criteria	

Sampling method (purposive, stratified, randomised with control etc.)	
How was the sample selected? Any factors that influenced how the sample was selected (e.g. access, timescale issues)?	
Data collection methods? Method of outcome reporting (self, diary, observation etc.) Adequately described and rigorously conducted?	

Analysis and reporting

	Please state
Outcome measures used Appropriate?	 Yes / No / Unclear
Statistical methods used	

Risk of bias assessment?	Yes No Unclear Comment

Results

	Please state
How many invited to participate? What percentage of selected individuals agreed to participate? Total number randomised (or total pop. At start of study for RCTs) Number / percentage who completed the study? Attrition rate?	
For cluster trials, number of clusters, number of people per cluster	
Number allocated to each intervention group	
Any significant baseline imbalances?	Yes No Unclear

Number and reason for withdrawals and exclusions for each intervention group	
Were participants who entered the study adequately accounted for?	
What percentage of participants completed the study?	
Missing data accounted for?	Yes No Unclear
Did intervention include strategies to address equality / diversity/disadvantage?	Yes No Unclear
Theoretical basis of engagement strategy (for example, SCT, TPB) Comments	
Moderators/mediators of study changes? Comments	
Study conclusions	

Appendix C: Systematic review summary of excluded articles

Study Details	Study background	Reason for exclusion
Adams (2013) An Adaptive Physical Activity Intervention for Overweight Adults: A Randomized Controlled Trial. PLoS ONE 8(12): e82901. doi:10.1371/journal.pone.0082901	The objective was to test an adaptive intervention for physical activity based on operant and behaviour economic principles and a percentile based algorithm. Age range was 18 to 65 years old. Participants needed to be inactive and overweight. The target for both groups was walking 10,000 steps/day on five or more days per week.	Not older people.
Cecchini (2010) Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. Lancet 376: 1775–84	The objective was to develop an intervention aimed at tackling obesity by improving diets and increasing physical activity in low-income and middle-income countries. Examined price interventions and regulation. Targeted children.	Not older people. Not exercise.

Study Details	Study background	Reason for exclusion
Cornelis (2014) Being healthy or looking good? The effectiveness of health versus appearance-focused arguments in two-sided messages Journal of Health Psychology 2014, Vol. 19(9) 1132– 1142	A convenience sample of 304 subjects (69.5% females, mean age = 30.96, age range = 18–65 years	Not older people. Unclear if community setting. Unclear if focus was adherence or whether an intervention was provided.
Dai (2001) Effectiveness of a multidisciplinary rehabilitation programme in elderly patients with hip fractures. Journal of the Formosan medical Association	Set in the backdrop of hip fractures. Study aimed to evaluate the effectiveness of a multidisciplinary rehab program in older patients with hip fractures. Average participant age was 76.84.	Not community set. No engagement strategy.

Study Details	Study background	Reason for exclusion
Demark-Wahnefried (2009) Promoting Healthy Lifestyles in Older Cancer Survivors to Improve Health and Preserve Function JAGS 57:S262–S264	Discusses various studies, rather than forming a primary interventional study focused upon engagement strategies for older people's exercise.	Not community set. No physical exercise component. No engagement strategy.
Figueiredo (2013) Nordic walking for geriatric rehabilitation: a randomised pilot trial. Disability and rehabilitation 35 (12): 968 – 975	Aimed to identify effective interventions which promote walking capacity in older people. Nordic walking and usual over ground walking were compared. They estimated the relative efficacy in improving walking capacity. Outcome measures focussed upon functional capacity. Participant's mean age was 78 years.	No engagement strategy. Outcome measures focused upon increased walking speed.
Forkan (2006) Exercise adherence following physical therapy intervention	Utilised survey questionnaires with a convenience sample of 630 adults aged 65 years and older who had completed	No engagement strategy.

Study Details	Study background	Reason for exclusion
in older adults with impaired balance. Physical Therapy 86 (3): 401-410	a physical therapist-supervised balance training programme. The exercise programmes are based in the hospital but performed as outpatients.	
Heron (2014) Steps to a better Belfast: physical activity assessment and promotion in primary care. British Journal of Sports Medicine 2014;48: 1558–1563	Aimed to explore the feasibility of a randomised trial of a pedometer-based intervention, using step count goals. Participants were aged 35 to 75 years. Primary outcome measure was step count.	Not older people. No engagement strategy.
Khaw (2008) Combined impact of health behaviours and mortality in men and women: the EPIC Norfolk prospective population study. PLoS	Examined the prospective relationship between lifestyle and mortality in a prospective population study of 20,244 participants aged 45 to 79 years. No intervention was provided. Study served as a predictor of health behaviours.	Not older people. No engagement strategy. Not interventional.

Study Details	Study background	Reason for exclusion
medicine S (1): e12 DOI: 10.1371/journal.pmed.0050012		
Murphy (2013) Does doing housework keep you healthy? The contribution of domestic physical activity to meeting current recommendations for health. BMC public health 13:966 http://www.biomedcentral.com/1471-2458/13/966	Study formed a secondary analysis of a cross-sectional survey of Northern Irish adults. A negative association was demonstrated between domestic physical activity and leanness.	Not older people. Not interventional. Unclear if focus was exercise engagement.
Olsen (2014) The effect of exercise and education on fear of falling in elderly women with osteoporosis and	Set in the backdrop of osteoporosis and vertebral fracture. Study aimed to explore the effect of a group based exercise programme and an educational session on the	No engagement strategy.

Study Details	Study background	Reason for exclusion
history of vertebral fracture: results of a randomised controlled trial. Osteoporosis international 25 2025 DOI: 10.1007/S00198–014–2724–3	fear of falling amongst 89 women. The community set interventions provided a three month long exercise programme combined with education which focused on the reduction of falls risk and challenges specific to osteoporosis and vertebral fractures. Participant age range was 60 to 83 years. The objective was to reduce falls risk.	
Patil (2015) Falls and injuries in older women: a two-year community-based randomised controlled trial. Journal of the American geriatric Society 63:1306 – 1313	Study investigated the effects of community set, multimodal supervised exercise and physical functioning in the backdrop of falls and related injuries in older women. The age range of participants was 70 to 80 years; all had experienced falls within the previous year.	No engagement strategy.
Shaw (2008) A pilot community-based walking for exercise program for	Set in the backdrop of inactivity. The pilot study aimed to determine whether a physiotherapy based programme would result in differences in the scores of the Yale	No engagement strategy.

Study Details	Study background	Reason for exclusion
senior women. Topics in geriatric rehabilitation 24 (4): 315 – 324	Physical Activity Survey for older women who were provided with mobility aids, versus those who were not.	
Tseng (2003) Exercise motivation and processes of change in community dwelling older persons. Journal of nursing research 11 (4): 269 – 275	Study used the trans-theoretical model in the promotion of healthy behaviours. The research questions were: what are the most common forms of exercise used by older people; what was the distribution of exercise stages of change in older people; did processes of change differ across exercise stages of change.	Focused upon healthy behaviours. Not interventional. No engagement strategy.
Verrusio (2014) Exercise training and music therapy in elderly with depressive syndrome: a pilot study Complimentary therapies in medicine 22:614 – 620	Study aimed to evaluate the impact of community set physical training and musical therapy on a sample group of participants affected by light to moderate depression versus participants treated with pharmacological therapy only. Participant mean age was 75.5 years.	No engagement strategy.

Study Details	Study background	Reason for exclusion
Zhu (2014) The effects of a trans-theoretical model based exercise stage-managed intervention on exercise behaviour in patients with coronary heart disease: a randomised controlled trial. Patient education and counselling 95:384 – 392	Study aimed to determine whether a trans-theoretical model based on exercise staged management intervention has positive effects on the exercise behaviour of sedentary patients with coronary heart disease. Participants were aged between 61 and 70 years, however only 16.9% were aged over 70 years.	Not older people.

Appendix D: Governance for studies

Health Research Authority
East Midlands - Nottingham 1 Research Ethics Committee
Royal Standard Place
Nottingham
NG1 6FS
Telephone: 0115 8839521

13 January 2016
Prof Pip Logan
Division of Rehabilitation and Aging,
School of Medicine, Room B108a, B Floor
University of Nottingham
NG7 2UH
Dear Professor Logan

Study title:	**Developing an intervention to increase Older People's Rehabilitative Exercise Engagement (OPREE): An exploratory and Proof of Concept study.**
REC reference:	**16/EM/0027**
Protocol number:	**15117**
IRAS project ID:	**171548**

The Proportionate Review Sub-Committee of the East Midlands - Nottingham 1 Research Ethics Committee reviewed the above application on 12 January 2016.

Provisional opinion

The Sub-Committee would be content to give a favourable ethical opinion of the research, subject to clarification of the following issues and/or the following changes being made to the documentation for study participants:

1. Please clarify what the interventions will be in the Proof of Concept part of the study.
2. Please clarify that medical rights will not be affected in the paragraph in the patients Participant Information Sheet entitled '*What will happen if I don't want to carry on with the study'.*
3. Please consolidate the recruitment email to staff and provide a flyer type document as recommended by the PR Sub-Committee.
4. Please clarify if interviews will be recorded and if so explain this in the Participant Information Sheets, if not remove the point referring to it in the consent forms.

The committee require the following changes to be made to the Consent Forms:
a) Please remove references to medical care in staff consent form.
b) Please fix numbering on all consent forms.
c) Please change consent forms so each point only deals with a separate issue.
d) Please remove references to '*measurements'* in all consent forms.

When submitting a response to the Sub-Committee, the requested information should be electronically submitted from IRAS. A step-by-step guide on submitting your response to the REC provisional opinion is available on the HRA website using the following link: http://www.hra.nhs.uk/nhs-research-ethics-committee-rec-submitting-response-provisional-opinion/

Please submit revised documentation where appropriate underlining or otherwise highlighting the changes which have been made and giving revised version numbers and dates. You do not have to make any changes to the REC application form unless you have been specifically requested to do so by the REC.

Authority to consider your response and to confirm the final opinion on behalf of the Committee has been delegated to the chair.

Please contact George Martin, nrescommittee.eastmidlands-nottingham1@nhs.net if you need any further clarification or would find it helpful to discuss the changes required with the lead reviewer.

The Committee will confirm the final ethical opinion within 7 days of receiving a full response. A response should be submitted by no later than 12 February 2016.

Social or scientific value; scientific design and conduct of the study

The PR Sub-Committee discussed how this study will find out what support is needed to help people adhere to the SBE regime. The members noted that the study is well designed and utilises a lightweight questionnaire that will not be too taxing for participants to complete. The Committee discussed how the proof of concept part of the trial has yet to be developed yet a Participant Information Sheet was submitted for it. It was agreed that as a result this Participant Information Sheet is very vague, premature and complicated. The PR Sub-Committee agreed that they require clarification as to what the interventions will be in the proof of concept stage of the study.

Recruitment arrangements and access to health information, and fair participant selection

The PR Sub-Committee agreed that recruitment is handled well by health carers first.

Favourable risk benefit ratio; anticipated benefit/risks for research participants (present and future)

The PR Sub-Committee agreed that the study is low risk and the only harm that may come to participants is the emotional distress of completing the questionnaire.

Care and protection of research participants; respect for potential and enrolled participants' welfare and dignity

The PR Sub-Committee discussed how the Participants Information Sheet for patients does not mention medical rights along with legal rights and that it should state that medical care will not be withdrawn if patients are to remove themselves from the study.

Informed consent process and the adequacy and completeness of participant information

The PR Sub-Committee noted a number of typographical errors with the consent forms; The consent form for staff mentions *'medical care'*, the other consent forms mention interviews being recorded yet this is something that is not mentioned in the Participant Information Sheets. The PR Sub-Committee also noted that there is no number four on the forms and that the forms are numbered 1,2,3,5,6,7,8. The members also noted that the consent forms reference '*measurements'* in point five which may be related to a different study and asks for consent for two separate issues in a single tick box in a number of cases. The PR Sub-Committee agreed that the emails being sent to recruit staff are too long and should be consolidated, with the PR Sub-Committee members recommending that a flyer or leaflet be attached to the emails so members of staff can print and read at their leisure.

Suitability of the applicant and supporting staff

The PR Sub-Committee noted that the applicant and supporting staff have adequate experience to carry out the study.

Documents reviewed

The documents reviewed were: *Document*	*Version*	*Date*

Copies of advertisement materials for research participants [Clinicians recruitment advert]	Final 1.0	16 December 2015
Copies of advertisement materials for research participants [Clinicians recruitment focus groups advert]	Final 1.0	16 December 2015
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Liability insurance]		16 December 2015
Interview schedules or topic guides for participants [Interview guide]	Final 1.0	16 December 2015
Interview schedules or topic guides for participants [Exit interview guide]	Final 1.0	16 December 2015
IRAS Checklist XML [Checklist_18122015]		18 December 2015
IRAS Checklist XML [Checklist_07012016]		07 January 2016
Letter from sponsor [Sponsor letter]		16 December 2015
Letters of invitation to participant [Letter of invitation]	Final 1.0	16 December 2015
Non-validated questionnaire [Clinical staff questionnaire]	Final 1.0	16 December 2015
Participant consent form [Consent form - interviews]	Final 1.0	16 December 2015
Participant consent form [Consent form - focus groups]	Final 1.0	16 December 2015
Participant consent form [Consent for PoC]	Final 1.0	16 December 2015
Participant consent form [Consent form clinical PoC]	Final 1.0	16 December 2015
Participant information sheet (PIS) [PIS - interviews]	Final 1.0	16 December 2015
Participant information sheet (PIS) [PIS Focus Groups]	Final 1.0	16 December 2015
Participant information sheet (PIS) [PIS - clinicians]	Final 1.0	16 December 2015
Participant information sheet (PIS) [PIS PoC]	Final 1.0	16 December 2015
REC Application Form [REC_Form_18122015]		18 December 2015
REC Application Form [REC_Form_07012016]		07 January 2016
Research protocol or project proposal [OPREE protocol]	Final 1.0	16 December 2015
Summary CV for Chief Investigator (CI) [Summary CV Prof Pip Logan]	Final	18 December 2015
Summary CV for student [Summary CV Kevin Anthony]		18 December 2015

Membership of the Committee
The members of the Committee who were present at the meeting are listed on the attached sheet.
Statement of compliance
The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.
16/EM/0027 Please quote this number on all correspondence
Yours sincerely

Dr Carl Edwards
Chair
Email: NRESCommittee.EastMidlands-Nottingham1@nhs.net *Enclosures:* *List of names and professions of members who took part in the review*

Notice of continuing Research and Development support for study

Mitchell Shirley - Head of Research and Innovation <Shirley.Mitchell@nottshc.nhs.uk>

Tue 19/07/2016, 09:14

OPREE covering letter for major amendment.odt 141 KB	AmendmentForm_Locked version.pdf 193 KB	OPREE protocol Version 3.1 13Jul16.docx 121 KB	OPREE Consent form PoC version 2.0 11Jul16.doc 575 KB	OPREE PIS PoC version 2.1 13Jul2016.doc 597 KB

Morning Kevin

Thank you very much, please accept this email as continuing NHS permission for your research project at Nottingham CityCare Partnership

BW

Shirley

Shirley Mitchell
Head of Research and Innovation
Nottinghamshire Healthcare NHS Foundation Trust
Duncan MacMillan House
Porchester Road
Mapperley
Nottingham
NG3 6AA
Mobile: 07920 454530
Telephone: 0115 9691300 ext. 11903
Email: shirley.mitchell@nottshc.nhs.uk

From: Kevin Anthony [mailto:msxka9@nottingham.ac.uk]
Sent: 19 July 2016 08:30
To: Mitchell Shirley - Head of Research and Innovation
Cc: Pip Logan
Subject: RE: IRAS 171548 Confirmation of REC Validation and Categorisation of Amendment

Good morning Shirley,

Here are the relevant documents. Thanks for your continued help. There is a covering letter attached which explains that I am requesting permission to change two questionnaires so that we can more accurately reflect a slight change in project direction. I have also requested permission to collect attendance data with the use of SystmOne at the 6 month (rather than 4 month point).

Hope this is all OK.

Best regards

Kevin

Kevin Anthony

Research Physiotherapist / PhD Candidate

Caring for Older People and Stroke Survivors (COPSS),

CLAHRC East Midlands / Nottingham CityCare Partnership NHS

T: 07504 061 060; E: msxka9@exmail.nottingham.ac.uk

Division of Rehabilitation and Ageing, School of Medicine,

University of Nottingham, Room B114, B floor, Medical School,

Queens Medical Centre, Nottingham, NG7 2UH.

From: Mitchell Shirley - Head of Research and Innovation [Shirley.Mitchell@nottshc.nhs.uk]
Sent: 19 July 2016 07:49
To: Anthony Kevin
Subject: FW: IRAS 171548 Confirmation of REC Validation and Categorisation of Amendment

Hi Kevin

I received this yesterday, if you could send me through the relevant documentation please!

Thanks in advance

BW
Shirley

Shirley Mitchell

Head of Research and Innovation

Nottinghamshire Healthcare NHS Foundation Trust

Duncan MacMillan House
Porchester Road

Mapperley

Nottingham

NG3 6AA

Mobile: 07920 454530

Telephone: 0115 9691300 ext. 11903

Email: shirley.mitchell@nottshc.nhs.uk

From: Nottingham1 NRESCommittee.EastMidlands- (HEALTH RESEARCH AUTHORITY) [mailto:nrescommittee.eastmidlands-nottingham1@nhs.net]
Sent: 18 July 2016 10:06
To: Pip Logan; 'sponsor@nottingham.ac.uk'; Mitchell Shirley - Head of Research and Innovation
Cc: msxka9@nottingham.ac.uk
Subject: IRAS 171548 Confirmation of REC Validation and Categorisation of Amendment

Dear Professor Logan,

IRAS Project ID:	171548
REC Reference:	16/EM/0027
Short Study Title:	Older People's Rehabilitative Exercise Engagement: OPREE
Date complete amendment submission received:	18.07.2016
Amendment Date:	17.06.2016
Amendment Type:	**Substantial**

Thank you for submitting the above referenced amendment. I am pleased to confirm that this amendment has been submitted to the REC for ethical review. Please find attached a copy of the validation letter.

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

Our reference: RGS 15117
IRAS Project ID: 171458

Research and Graduate Services
University of Nottingham
King's Meadow Campus
Lenton Lane Nottingham
NG7 2NR

0115 9515679
Sponsor@nottingham.ac.uk

NHS Research Ethics Committee
Health Research Authority

Professor Pip Logan
Professor of Rehabilitation Research
Division of Rehabilitation and Ageing
School of Medicine
University of Nottingham

16 December 2015

Dear Chair of the Ethics Committee,

Sponsorship Statement

Re: Developing an intervention to increase Older People's Rehabilitative Exercise Engagement (OPREE): An Exploratory and Proof of Concept study

I can confirm that this research proposal has been discussed with the Chief Investigator and agreement to sponsor the research is in place.

An appropriate process of scientific critique has demonstrated that this research proposal is worthwhile and of high scientific quality.*

Any necessary indemnity or insurance arrangements will be in place before this research starts. Arrangements will be in place before the study starts for the research team to access resources and support to deliver the research as proposed.

Arrangements to allocate responsibilities for the management, monitoring and reporting of the research will be in place before the research starts.

The duties of sponsors set out in the NHS Research Governance Framework for Health and Social Care will be undertaken in relation to this research.**

* Not applicable to student research (except doctoral research).
** Not applicable to research outside the scope of the Research Governance Framework.

Yours faithfully

Angela Shone
Head of Research Governance
University of Nottingham

Appendix E: Letters of approach and targeted emails

Letter of invitation for staff interview

Falls and Bone Health Service
Room 43a New Brook House
385 Alfreton Road
Nottingham
NG7 5LR

XX January 2016

Dear

We would like to invite you to take part in an interview which is looking at ways in which we can improve our Falls and Bone Health Service.

The aim of the study is to develop an intervention that will increase the level of Older People's Exercise Engagement (OPREE). The interview would form part of our research study and will take approximately one hour. The study forms part of Kevin Anthony's (one of our senior Physiotherapists) Doctoral training and he will conduct the interview.

Why do you want to interview me?

We are interested in your opinions about reasons that affect whether or not you join in exercise. It might be that you have no experience of exercise in which case that is fine.

If you decide to take part:

- We will ask you to allow a researcher (Kevin Anthony) to come to your home or to another suitable place, and to take part in an interview.

- We will ask you about general information such as your age, gender, previous work, previous experience with exercise, health, and your functional abilities (e.g. are you able to do what you want to do?).
- We will ask you about what helps you to exercise and what makes it difficult.
- The interview will take no more than one hour.

You do not have to take part if you don't want to.

There should be no risks from taking part in the study.

Your usual medical care will stay the same. The interview is designed to ask your opinions and should not cause any distress.

Any information we collect will be kept strictly private.

We will tell other health professionals what we find at medical meetings and by writing articles in medical journals, but we never mention any individual by name or disclose any personal identifiable information.

This research is being jointly funded by the Collaboration for Leadership in Applied Health Research and Care (CLAHRC), and Nottingham CityCare Partnership. It is being organised by the University of Nottingham.

If you require any further information or have any concerns or questions about taking part in the study please return the enclosed reply slip or contact the Falls and Bone Health Service Co-Ordinator (telephone 0115 883 8307).

So that you can have time to consider whether you would like to take part, we will telephone you in approximately one week's time to ask whether you would be happy to take part in the interview. Thank you for taking the time to read this letter and we hope that you will consider taking part in this study.

Yours sincerely,



Paul Baggaley

Team Manager

Appendix F: Participant Information Sheets

Participant Information Sheet - interviews

(Draft Version 1.3 / Final version 0.0: 27.11.2015)

Title of Study: **The development of an intervention to increase Older People's Rehabilitative Exercise Engagement**

Name of Researcher(s):

Professor Pip Logan (Principle Investigator)

Mr Kevin Anthony (Research Therapist and PhD student)

We would like to invite you to take part in our research study. Before you decide whether or not to participate we would like you to understand why the research is being done and what it would involve for you. One of our team will go through the information sheet with you and answer any questions you have. Talk to others about the study if you wish. Do ask us if there is anything that is not clear.

What is the purpose of the study?

We want to improve the ways that older people take part in exercise. In particular, we are interested in your opinions about factors that affect whether or not you join in exercise. Therefore, we are conducting interviews where we invite you to discuss your experiences with exercises (it might be that you have no experience of exercise and that is fine), what helps you to do the exercise, and also what stops you doing the exercise.

This small study is being carried out by Kevin Anthony, a therapy researcher, as part of his PhD training with the Collaboration for Leadership in Applied Health Research and Care. The study and its results will be included in his thesis. The information collected will be used to assist in planning a small study and then a larger study which will help in the development of an intervention designed to help older people stay active.

Why have I been invited?

You are being invited to take part because you have been referred to the Postural Stability programme due to your increased risk of falling. We are inviting 12 participants like you to take part.

Do I have to take part?

No. It is up to you to decide whether to take part or not. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are free to withdraw at any time without giving a reason. This would not affect your legal rights.

What will happen to me if I take part?

We would like to visit you at home so that we can discuss your opinions about exercise.

We will arrange a time which is convenient to you to visit you at home. You do not have to go anywhere; however, if you would rather, we can arrange to meet somewhere that you would prefer.

You do not have to do any part of the assessment that you do not want to, or do not feel able to do. You can rest or stop the discussion at any point. A family member is welcome to be with you. Your part in the study will be finished once the interview is complete.

Expenses and payments

For your part in this study, you will be offered a £10 gift voucher.

What are the possible disadvantages and risks of taking part?

The majority of your involvement will mean that the only risk is that you might become upset for some reason. All efforts will be made to make sure that this does not happen. If you do become upset, we can offer to stop the interview or, alternatively, return on another day.

The only other risk that might occur is during the walking test. The researcher is experienced in these tests, and will make all efforts to ensure that risks are reduced.

What are the possible benefits of taking part?

We cannot promise the study will help you but the information we obtain from this study will help us develop programmes for other older people. A possible benefit for you is that we might identify features that help you to keep an active lifestyle, with the benefits that brings. If we find anything we think your GP should know about, we will tell them if you agree.

What happens when the research study stops?

After the study, there is no further involvement in the research. Your medical care will be provided by your usual practitioners. We plan to produce a summary of the results which will be easy for study participants to read and understand. If you would like a copy of this summary please initial the box on the consent form.

What if there is a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researcher who will do his best to answer your questions.

If you remain unhappy and wish to complain formally, you can do this by contacting the Patient Advice and Liaison Service (PALS):

Nottingham CityCare Partnership: Tel: 0115 8839600

Address: Standard Court, Park Row, Nottingham, Nottinghamshire, NG1 6GN

Will my taking part in the study be kept confidential?

Yes. All the information about your participation will be kept strictly confidential. We will follow ethical and legal practice and all information about you will be handled in confidence.

If you join the study, some parts of the data collected for the study will be looked at by authorised persons from the University of Nottingham who are supervising the research. They may also be looked at by authorised people to check that the study is being carried out correctly. Everyone will have a duty of confidentiality to you as a research participant and we will do our best to meet this duty.

Information will be held securely on paper and electronically at the University of Nottingham under the provisions of the 1998 Data Protection Act. All information which is collected about you during the course of the research will be kept **strictly confidential**, stored in a secure and locked office, and on a password protected database. Any information about you which leaves the hospital will have your name and address removed (anonymised); and a unique code will be used so that you cannot be recognised from it. Your personal data (address, telephone number) will be kept for six months after the end of the study so that we are able to contact you about the findings of the study. All other data (research data) will be kept securely for seven years. After this time, your data will be disposed of securely. Throughout this study, all precautions will be taken by everyone involved to maintain your confidentiality. Only members of the research team will have access to your personal data.

What will happen if I don't want to carry on with the study?

Just tell us and you can withdraw. You don't have to give an explanation but we will ask as it may help us change the training programme and there are only a few people within the study. Your participation is voluntary, and you are free to withdraw at any time, without giving any reason, and without your legal rights being affected. If you withdraw, then the information collected so far cannot be erased and this information would still be used in the project analysis.

Involvement of the General Practitioner/Family doctor (GP)

Unless you ask us to do so, we will not inform you GP or other health care practitioner who may be treating you. This is because your part only involves an interview. This would only be to inform them and provide contact details of the research team if they have any concerns about your involvement in the study.

What will happen to the results of the research study?

The results of the study will be used to develop a small study to test whether the new intervention works. We may also publish results in a medical journal or present them at scientific conferences. Results will be anonymous, and none of the participants will be identified in any report.

Who is organising and funding the research?

This research is being organised by the University of Nottingham and is being funded by the Collaboration for Leadership in Applied Health Research and Care and Nottingham CityCare Partnership.

Who has reviewed the study?

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by Nottingham Research Ethics Committee. The study has also been reviewed by the Research & Development Department of Nottingham CityCare Partnership.

Further information and contact details

You are encouraged to ask any questions you wish before, during or after your assessment. Please ask your researcher. If you require any further information or have any concerns while taking part in the study please contact:

Mr Kevin Anthony

Post-graduate Researcher / Physiotherapist, B114 Medical School, Queens Medical Centre, University of Nottingham, Nottingham NG7 2UH

Telephone: 0115 823 0228

Email: msxka9@exmail.nottingham.ac.uk

Thank you for taking the time to read this information sheet and to consider participating in this study. We hope that your participation could prove helpful to you personally and to our research.

Participant Summary Information Sheet: interviews

(Draft Version 1.2 / Final version 1.0: 17.11.2015)

Title of Study: **The development of an intervention to increase older people's rehabilitative exercise engagement: OPREE.**

Name of Researchers:

Professor Pip Logan (Principal Investigator)

Kevin Anthony (Post Graduate Researcher)

We would like to invite you to take part in our research study.

Why have I been selected to take part?

Because we are developing a programme designed to improve participation in strength and balance exercises. As part of this, we are very interested in hearing your opinions as someone who has taken part in strength and balance exercises, even if you withdrew early. In particular, we are interested in your views of those reasons which you believe to help and what factors obstruct you when you are prescribed exercises designed to help you recover from an injury or illness.

If you take part:

- We will ask you to allow a researcher to come to your home and to take part in an interview.
- We will ask about general information such as your age, gender, previous work, previous experience with exercise, health, and your functional abilities (are you able to do what you want to do).
- We will ask you about what helps you to exercise and what makes it difficult.
- The interview will take no more than one hour.

You do not have to take part, if you don't want to.

Please ask if you want more time to make up your mind, or if you need to know more. You can stop taking part at any time, just by telling us.

There should be no risks from the study.

Your usual medical care will stay the same. The interview is designed to ask your opinions and should not cause any distress. The independent Nottingham Research Ethics Committee has looked at the study and is happy to let us do it.

Any information we collect will be kept strictly private.

We will tell other health professionals what we find at medical meetings and by writing articles in medical journals. But we never mention any names.

This research is being jointly funded by the Collaboration for Leadership in Applied Health Research and Care (CLAHRC), and Nottingham CityCare Partnership. It is being organised by the University of Nottingham. If you require any further information or have any concerns while taking part in the study please contact:

Kevin Anthony, Post Graduate Research Physiotherapist, Division of Rehabilitation & Ageing, Medical School, Queens Medical Centre, University of Nottingham, Nottingham NG7 2UH

Tel: 0115 8230228 or 0115 8838307;

Email: msxka9@exmail.nottingham.ac.uk

Thank you for taking the time to read this information sheet and to consider this study.

(Draft Version 1.3 / Final version 1.0: 26.11.2015)

The development of an intervention to increase older people's rehabilitative exercise engagement: OPREE.

Name of Researchers:

Professor Pip Logan (Principal Investigator)

Kevin Anthony (Post Graduate Researcher)

We would like to invite you to take part in our research study.

What is the purpose of the study?

The study is trying to understand what factors influence older people and their engagement with exercising. This focus group will build on patient interviews and will give another perspective before we develop an intervention.

Why have I been invited?

You have been invited to take part in this study because we are developing a programme designed to improve participation in strength and balance exercises and are very interested in your views as a healthcare worker who is involved in rehabilitating older people. In particular we are interested in your opinions relating to the reasons which you believe to help and what factors obstruct patients when they are prescribed exercises designed to help them recover from an injury or illness.

Do I have to take part?

No. You do not have to take part, if you don't want to.

Please ask if you want more time to make up your mind, or if you need to know more. You can withdraw from the study at any time, just by telling us. You do not need to give a reason.

What will happen to me if I take part?

- We will ask you to take part in one of two focus groups. Both groups will occur in a room within Mary Potter Centre, Hyson Green, on a date yet to be arranged. Each focus group will be made up of no more than eight participants. Participants will vary in discipline, occupational band, gender and experience. All will have experience of older people's rehabilitation.
- We will ask about general information such as your age, profession, previous experience with older people and exercise, and what helps or hinders older people to continue exercising.
- The focus group will take approximately one hour.

Are there any disadvantages and risks from taking part?

The focus group is designed to ask your opinions and should not cause any distress.

Who has reviewed and approved the study?

The independent Nottingham Research Ethics Committee has looked at the study and is happy to let us do it.

What are the possible benefits of taking part?

We hope that the focus group will make an interesting discussion, give you an insight into the research process, and also give you the opportunity to help in the development of an improvement to clinical practice.

What happens when the study stops?

The study forms part of PhD training, but the hope is that we will be to let others know about the study and that we can develop it further. Please tell us if you would like a short summary of the study results.

Will my taking part in the study be kept confidential?

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence**.**

We will not access any of your medical or professional records. Any information that we collect will be stored in a secure and locked office, and on a password protected database. No names or addresses will be retained and all personal data will be stored in a form that does not allow you to be recognised (anonymised).

What will happen if I don't want to carry on with the study?

Your participation is entirely voluntary and you are free to withdraw at any time, without giving reason, and without your legal rights being affected. If you do withdraw, then any information gathered so far cannot be erased and this information may still be used in the project analysis.

What will happen to the results of the research study?

We will tell other health professionals what we find at medical meetings and by writing articles in medical journals. But we never mention any names.

What if there is a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions. If this does not deal with your concern, you can contact Kevin Anthony. His contact details are given at the end of this information sheet.

If you remain unhappy and wish to complain formally, you can do this by contacting the Patient Advice and Liaison Service (PALS).

Address: Standard Court, Park Row, Nottingham, Nottinghamshire, NG1 6GN. Tel: 0115 8839600

Who is organising and funding the research?

This research is being jointly funded by the Collaboration for Leadership in Applied Health Research and Care (CLAHRC), and Nottingham CityCare Partnership. It is being organised by the University of Nottingham. If you require any further information or have any concerns while taking part in the study please contact:

Further information and contact details.

Kevin Anthony, Post Graduate Research Physiotherapist, Division of Rehabilitation & Ageing, Medical School, Queens Medical Centre, University of Nottingham, Nottingham NG7 2UH

Tel: 0115 8230228 or 0115 8838307.

Email: msxka9@exmail.nottingham.ac.uk

Thank you for taking the time to read this information sheet and to consider taking part in this study.

Participant Information Sheet – Proof of Concept study

(Final version 1.0 16Dec15)

Title of Study: Development of an intervention to increase Older People's Rehabilitative Exercise Engagement

Name of Researcher(s):

Professor Pip Logan (Principle Investigator)

Mr Kevin Anthony (Research Therapist and PhD student)

We would like to invite you to take part in our research study. Before you decide whether or not to participate we would like you to understand why the research is being done and what it would involve for you. One of our team will go through the information sheet with you and answer any questions you have. Talk to others about the study if you wish. Do ask us if there is anything that is not clear.

What is the purpose of the study?

We want to improve the ways that older people engage in exercise and this study aims to develop an intervention that will help older people stay active.

This study is being carried out by Kevin Anthony, a therapy researcher, as part of his PhD training with the Collaboration for Leadership in Applied Health Research and Care. The study and its results will be included in his thesis. The information collected will be used to develop an intervention designed to help.

Why have I been invited?

You are being invited to take part because you have been referred to the Strength and Balance Exercise (Postural Stability) programme due to your increased risk of falling. We are inviting 12 participants like you to take part.

Do I have to take part?

No. It is up to you to decide whether to take part or not. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are free to withdraw at any time without giving a reason. This would not affect your legal rights.

What will happen to me if I take part?

The aim of this study is to test whether or not an addition to strength and balance exercises has the potential to be used. You will receive your usual treatment plus the addition.

The additional treatment will be specifically tailored to you. For example, the additional treatment might be telephone prompts to perform home exercises, or a signposting to counselling services; equally the intervention might form the facilitation of entry to a leisure centre. Any treatment will be initiated prior to starting your usual treatment (strength and balance exercises). This will be in addition to SBE, and tailored to you. Where possible, the additional intervention will be delivered by Kevin Anthony. However, where necessary, your exercise instructor will be requested to deliver specifically identified changes to your normal treatment. Any change will be agreed with you. Kevin Anthony will not deliver your normal treatment.

As part of the study, we will ask you to take part in two short interviews: one before the new addition to your normal treatment, and one at the end. Both interviews will aim to understand your opinions about the additional part of your normal treatment. Both interviews will last no more than one hour and will involve the completion of questionnaires; we will send these

to you before both interviews and offer to help complete these during the interview if necessary. Once the second interview is completed, your involvement in the study will be finished. Therefore, the maximum time that you will be involved in the study is 6months and two weeks.

Expenses and payments

You will not be paid to take part in the study.

What are the possible disadvantages and risks of taking part?

We will be making changes to your routine that you should find to be acceptable. The changes have all been found to work in other ethically approved studies or will have been approved for use in the NHS. However, all potential risks will be discussed when the changes are made at the initial assessment.

Your normal treatment is strength and balance exercises. Your therapist will have already discussed these exercises with you. There is a risk that these exercises might cause some slight discomfort from your muscles; if this is the case, you should discuss these with the exercise instructor and they will discuss how to modify them with you. If you do experience these and you believe that they cause you to stop exercising, please tell the researcher because this will be of interest for the research. You will not be asked to do anything that you cannot or do not wish to do.

What are the possible benefits of taking part?

We cannot promise the study will help you but the information we obtain from this study may help us develop training programmes. You may also find a physical benefit by completing the strength and balance exercise programme and decide to continue with these kinds of exercises in the future if you wish.

What happens when the research study stops?

After the study, there is no further involvement in the research. Your medical care will be provided by your usual practitioners. We plan to produce a summary of the results. If you would like a copy of this summary please initial the box on the consent form.

What if there is a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researcher who will do his best to answer your questions. If this does not deal with your concern, you can contact Professor Pip Logan, whose contact details are given at the end of this information sheet.

If you remain unhappy and wish to complain formally, you can do this by contacting the Patient Advice and Liaison Service (PALS):

Nottingham CityCare Partnership: Tel: 0115 8839600

Address: Standard Court, Park Row, Nottingham, Nottinghamshire, NG1 6GN

Will my taking part in the study be kept confidential?

Yes. All the information about your participation will be kept strictly confidential. We will follow ethical and legal practice and all information about you will be handled in confidence.

If you join the study, some parts of the data collected for the study will be looked at by authorised persons from the University of Nottingham who are supervising the research. They may also be looked at by authorised people to check that the study is being carried out correctly. Everyone will have a duty of confidentiality to you as a research participant and we will do our best to meet this duty.

Information will be held securely on paper and electronically at the University of Nottingham under the provisions of the 1998 Data Protection Act. All information which is collected about you during the course of the research will be kept **strictly confidential**, stored in a secure and locked office, and on a password protected database. Any information about you will have your name and address removed (anonymised); and a unique code will be used so that you cannot be recognised from it. Your personal data (address, telephone number) will be kept for six months after the end of the study so that we are able to contact you about the findings of the study. All other data (research data) will be kept securely for seven years. After this time, your data will be disposed of securely. Throughout this study, all precautions will be taken by everyone involved to maintain your confidentiality. Only members of the research team will have access to your personal data.

What will happen if I don't want to carry on with the study?

Just tell us, and you can withdraw. You don't have to give an explanation but we will ask as it may help us change the training programme and there are only a few people within the study. Your participation is voluntary, and you are free to withdraw at any time, without giving any reason, and

without your legal rights being affected. If you withdraw, then the information collected so far cannot be erased and this information would still be used in the project analysis.

What will happen to the results of the research study?

The results of the study will be used to develop a larger study to test whether the new falls prevention programme works. We may also publish results in a medical journal or present them at scientific conferences. Results will be anonymous, and none of the participants will be identified in any report.

Who is organising and funding the research?

This research is being organised by the University of Nottingham and is being funded by the Collaboration for Leadership in Applied Health Research and Care.

Who has reviewed the study?

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee, to protect your interests. This study has been reviewed and given favourable opinion by Nottingham Research Ethics Committee. The study has also been reviewed by the Research & Development Department of Nottingham CityCare Partnership.

Further information and contact details

You are encouraged to ask any questions you wish before, during or after your assessment. Please ask your researcher. If you require any further information or have any concerns while taking part in the study please contact:

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Thank you for taking the time to read this information sheet and to consider participating in this study. We hope that your participation could prove helpful to you personally and to our research.

Appendix G: Interview schedules

Developing an intervention to increase Older People's Rehabilitative Exercise Engagement (OPREE): An Exploratory and Proof of Concept study

Sponsor reference: 15117

Final version 1.0: 16th December 2015

OPREE Interview Guide

Thank you for agreeing to take part in this study. We are interested in finding out what you think about exercise. In the interview, we ask about physical activity; by this we mean any exercise you might do, for example,

swimming, walking, or keep fit. However, it also includes other types of activity such as gardening, housework, dancing, or DIY. If you are not sure what any of the questions mean, please let me know. At the end, I will ask you if there is anything else that you would like to add that hasn't been covered by the questions I am going to ask.

Question	Prompts	COM
When you were younger, how physically active would you say that you were?	What sort of exercise? Why? What made you go? Did you enjoy exercise?	Motivation Capability
Within the last 2-3 years, how physically active would you say that you were?	What sort of exercise? Why? What makes you go?	Motivation Capability
Where have you exercised in the past?	Leisure centre / gardening etc. Home exercises versus class sessions – thoughts?	Opportunity
So, if you prefer one, what puts you off the other?	E.g. Why home versus class? Cost, distance, availability, perceived safety etc.?	Opportunity
When you were offered the opportunity to take part in the strength and balance exercise programme, how did you feel?	Able / unable? Worried / excited? Why? Looking forward to / worrying about anything in particular?	Capability Motivation
If we look at your life, how do you think that exercise fits in: Does it help or hinder?	Priorities?	Opportunity Motivation
Do you think that exercise is safe for you?	Fear of adverse effects such as angina	Capability
If you can't exercise regularly, do you think that you should bother?	Knowledge of exercise	
The recommendations are that everyone should exercise for at least 2.5 hours per week (150 minutes). Would you say	What helps you / stops you exercising for this long?	Capability Opportunity Motivation

that you exercise less than, about that, or more than that?		
We are trying to develop a programme that will help older people to exercise. What features do you think that it should have?	What, where, when? Affordable, practical, acceptable, effective, side effects, equality.	

OPREE Focus Group Guide

Thank you for agreeing to take part in this study.

Take consent as a group and use the PIS as the background to the outline of the study.

Ground rules. Respect for each other.

Name badges to be provided and worn but introductions kept to a minimum.

"I have a series of questions to help the discussion, but I would prefer this to be a conversation rather than a question and answer session. At the end, I will ask you if there is anything else that you would like to add that hasn't been covered."

Question
What are your experiences of older people engaging in exercise?
What factors do you think affect a high level of exercise engagement?
If we look at older people's sociality, how do you think that exercise fits in: Does it help or hinder?
Do you think strength and balance exercises are a useful intervention?
The literature suggests that many older people don't stick with exercise programmes. What do you think we should do about it?
How can we improve SBE? What components?

If you were to commission a perfect strength and balance exercise programme, what would it look like?

Thank you. Questions or points? Would you like a short summary of the study?







Developing an intervention to increase Older People's Rehabilitative Exercise Engagement (OPREE): An Exploratory and Proof of Concept study

Sponsor reference: 15117

Final version 1.0: 16th December 2015

OPREE Exit Interview Guide

Thank you for agreeing to take part in this study. Now that you have come to the end of the study, we wanted to ask you about the study itself and any changes that have happened since the last interview. At the end, I will ask you if there is anything else that you would like to add that hasn't been covered by the questions I am going to ask.

Question	Prompts	COM
Before you started the study, what were your thoughts?	Excitement, fear, concern, curiosity Can I cope?	Capability Opportunity Motivation
As the study progressed, how did these feelings change?		Capability Opportunity Motivation
If we look at your life, how do you think that exercise fits in: Does it help or hinder?	Priorities?	Opportunity Motivation
Looking at the addition to the strength and balance exercise programme, what did you think could be improved?	What? Why? Suggestions?	
What components of the additional intervention did you like?	What? Why? Suggestions?	
What do you understand by the term exercise?	How does this differ from the term activity?	
Where do you exercise now?	Leisure centre / gardening etc. Home exercises versus class sessions – thoughts?	Opportunity
The recommendations are that everyone should exercise for at least 2.5 hours per week (150 minutes). Would you say that you currently exercise less than, about that, or more than that?	What helps you / stops you exercising for this long?	Capability Opportunity Motivation

Do you think that you will continue to exercise after this study?	Where? Intention versus plan?	Capability Opportunity Motivation
We are trying to develop a programme that will help older people to exercise. What features do you think that it should have?	What, where, when? Affordable, practical, acceptable, effective, side effects, equality.	

Thank you. Questions or points you would like to make? Would you like a short summary of the study?

Appendix H: BREQ3, SF12 and NEADLS Questionnaires

EXERCISE REGULATIONS QUESTIONNAIRE (BREQ-3)

WHY DO YOU ENGAGE IN EXERCISE?

We are interested in the reasons underlying peoples' decisions to engage or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

Statement	**Not true**	**Sometimes true for me**			**Very True for me for me**
It's important to me to exercise regularly	0	1	2	3	4
I don't see why I should have to exercise	0	1	2	3	4
I exercise because it's fun	0	1	2	3	4

I feel guilty when I don't exercise	0	1	2	3	4
I exercise because it is consistent with my life goals	0	1	2	3	4
I exercise because other people say I should	0	1	2	3	4
I value the benefits of exercise	0	1	2	3	4
I can't see why I should bother exercising	0	1	2	3	4
I enjoy my exercise sessions	0	1	2	3	4
I feel ashamed when I miss an exercise session	0	1	2	3	4
I consider exercise part of my identity	0	1	2	3	4
I take part in exercise because my friends /family /partner say I should	0	1	2	3	4
I think it is important to make the effort to exercise regularly	0	1	2	3	4
I don't see the point in exercising	0	1	2	3	4
I find exercise a pleasurable activity	0	1	2	3	4
I feel like a failure when I haven't exercised in a while	0	1	2	3	4
I consider exercise a fundamental part of who I am	0	1	2	3	4
I exercise because others will not be pleased with me if I don't	0	1	2	3	4
I get restless if I don't exercise regularly	0	1	2	3	4
I think exercising is a waste of time	0	1	2	3	4
I get pleasure and satisfaction from participating in exercise	0	1	2	3	4
I would feel bad about myself if I was not making time to exercise	0	1	2	3	4
I consider exercise consistent with my values	0	1	2	3	4
I feel under pressure from my friends/ family to exercise	0	1	2	3	4

SF12 (v2): Your Health and Well-Being

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Thank you for completing this survey! For each of the following questions, please mark the one box that best describes your answer.

1. In general, would you say your **health** is:

Excellent$_1$	Very good$_2$	Good$_3$	Fair$_4$	Poor$_5$

2. The following questions are about **activities** you might do during a **typical day**. Does your health now limit you in these activities? If so, how much?

	Yes, limited a lot$_1$	Yes, limited a little$_2$	No, not limited at all$_3$
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf			
Climbing several flights of stairs			

3. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities result of your **physical health**?

	All of the time $_1$	Most of the time$_2$	Some of the time$_3$	A little of the time$_4$	None of the time$_5$
Accomplished less than you would like					
Were limited in the kind of work or other activities					

4. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any **emotional** problems (such as **feeling depressed or anxious**)?

	All of the time$_1$	Most of the time$_2$	Some of the time$_3$	A little of the time$_4$	None of the time$_5$
Accomplished less than you would like					
Did work or other activities less carefully than usual					

5. During the past 4 weeks, how much did **pain** interfere with your **normal work** (including both work outside the home and housework)?

Not at all$_1$	A little bit$_2$	Moderately$_3$	Quite a bit$_4$	Extremely$_5$

6. These questions are about **how you feel and how things have been with you during the past 4 weeks**. For each question, please give the one answer that comes **closest to the way you have been feeling**.

How much of the time during the past 4 weeks...

	All of the time$_1$	Most of the time$_2$	Some of the time$_3$	A little of the time$_4$	None of the time$_5$
Have you felt calm and peaceful?					
Did you have a lot of energy?					
Have you felt downhearted and depressed?					

7. During the past 4 weeks, how much of the time has your **physical health or emotional problems** interfered with your **social** activities (like visiting friends, relatives, etc.)?

All of the time$_1$	Most of the time$_2$	Some of the time$_3$	A little of the time$_4$	None of the time$_5$

Nottingham Extended ADL Scale

The following questions are about everyday activities. Please answer by ticking ONE box for each question. Please record what you have ACTUALLY done in the last few weeks.

DID YOU…….	Not at all	With help	On your own with difficulty	On your own
Walk around outside?				
Climb stairs?				
Get in and out of a car?				
Walk over uneven ground?				
Cross roads?				
Travel on public transport?				
Manage to feed yourself?				
Manage to make yourself a hot drink?				
Take hot drinks from one room to another?				
Do the washing up?				
Make yourself a hot snack?				
Manage your own money when out?				
Wash small items of clothing?				
Do your own housework?				
Do your own shopping?				
Do a full clothes wash?				
Read newspapers or books?				
Use the telephone?				
Write letters?				
Go out socially?				
Manage your own garden?				
Drive a car?				

Appendix I: Example of interview transcript

Excerpt from interview with Respondent Five. Line numbers were inserted.

P5: You know they go round and say, you know everybody introduces you by name when you first start, and when a new person comes then they say who it is. You know you don't-- I don't think we said-- oh we might have done-- where we'd had a fall, I can't remember to be quite honest about that. But you know we--we--we go round the circle.

R: Okay. So you all introduce yourselves?//

P5: All introduce ourselves on the first week, I'm sure we did yeah//

R: You don't do a group hug do you?

P5: … No ((laughter)) no we don't do a group hug, we used to a--a umm like a laughing thing at the end//

R: Oh yeah//

P5: Yeah, yeah.

R: Used to but you don't do it anymore?//

P5: We don't always used--we didn't always do it//

R: Right//

P5: but we did it quite a lot.

R: Okay//

P5: Yeah, sometimes she'd forget

R: And what do you think of that?

P5: I thought that was quite good.

R: ((laughter)) Oh okay.

P5: Well it's fun isn't it?

R: Yeah. Is it the fun side of it?

P5: Yeah. I thought that the older--the-- I mean I--I-- this is me thinking I'm young again-- but I used to go home and--and talk to my daughter about it. And I used to say "do you know it's really"-- I felt it was benefit-- it was helping me but I felt it was helping them more.

R: Okay.

P5: Because she'd pick up on things, like one of the girls had umm is it Meniere's

R: Okay.

P5: the one that can make you dizzy?//

R: Yeah.

P5: and she told her about something that she could do through the doctors, and I thought "well that was good." And then somebody else was struggling walking a bit and she said "Oh I-- we'll organise-- go to so and so and we'll get you sorted out with a frame" and then when the lady got the frame and she came and you know you could see she was uplifted, "oh I've got this" and it sort of helped--it--it helped so she was--she was doing the class, but she was interested in the people that were there and she was helping them a bit. But that's probably their job.

R: … Yes and no. If you take your son who is…a personal trainer//

P5: Yeah//

R: he doesn't have any health training… All of our instructors do.

P5: Yeah.

R: They've got a health awareness//

P5: Yeah.

R: like Meniere's

P5: Yeah.

R: osteoporosis

P5: Yeah.

R: and things like that.

P5: Yeah.

R: …And that's how she's able to actually say "oh that sounds like"//

P5: Yeah, yeah. You see my son did it at university

R: Yeah.

P5: but he's not gone--and I--I wanted him to be a physio but he wouldn't do that. You know and he's not--he--he does less and less training-- he does internet umm training online or I don't know what he does and that training. Umm but his--his biggest thing is his triathlon//

R: Yeah. Yeah//

P5: You know his triathlon holidays err but he still does--he still trains people that he's always trained//

R: Okay, yeah//

P5: and he must be good 'cause he had somebody from Paris come over the other week for a day, so I think he's quite well known in his field

R: Yeah.

P5: and he does quite well.

R: Yeah.

P5: And he's--he's you know and when I told him about these groups he was quite interested really. He was asking me about it.

R: Mmm. Okay//

P5: "Well that sounds good mum" and--

R: So who do you think should provide these exercise programmes? Do you think that it should just be NHS or should we outsource?

P5: ((pause)) well I thought the girls who did it were very good.

R: Okay//

P5: I don't know what other people are saying

R: Mhmm.

P5: but I thought they'd been trained quite well, I thought they were very caring.

R: Yeah.

P5: Because they're from that profession aren't they?

R: Yeah.

P5: Umm and I wondered if you do have a-- if you--if you-- if you're going to have a personal trainer, it's har--it's hard, you think, personal trainer you think "oh goodness me that's going to be hard work."

R: Right.

P5: Whereas there it wasn't, it was--it--it-- the social thing made-- they made the exercises… f--fun and she changed things, and she made you laugh//

R: Yeah//

P5: and she'd pick up on somebody not doing something right and she'd say "oh Lesley you don't know your right from your left and you're rubbish!" and

R: Yeah.

P5: and everybody'd laugh and he--and he'd say something and that I thought was good.

R: Okay. So it's banter?

P5: Banter yeah.

R: Okay.

P5: Yeah.

R: But it's also that support at the right time?

P5: Yeah 'cause we had another man who came to do it

R: Yeah.

P5: then a man come

R: Yeah.

P5: umm who--who does the falls and he was more--he was--he stood at the front and he was more stricter and probably a bit more focused, I don't know//

R: Yeah.

P5: umm but I didn't enjoy that week as much as I did with the girls.

R: Was that just because it was a different change of person?

P5: Yeah probably, it was a different change of person and probably it was--it was a lot marching and a more--

R: Yeah.

P5: more--more regimented thing//

R: Right.

P5: I thought. But-- and he said afterwards he said "goodness me" he said "you're really good."

R: Okay.

P5: To all of us.

R: Yeah.

P5: Because he says "I'm not used to this sort of group." And I thought "well if your group have to--and they've had lots of falls and they're having to do that" but whether he did something else and he came and did that, and he knew that we were going to be better

R: Yeah.

P5: so he pushed us a little bit more probably.

R: What about venue?

P5: ((pause)) umm the venues we had?

R: Mmm.

P5: We had two venues, we had the YMCA

R: Mmm.

P5: which I thought was fine.

Appendix J: Example of Framework Analysis

Example of initial codes during analysis

Code	Theme	Participant	Line
I've got a new knee, my right knee's a new knee. … I've got arthritis in my--in both feet, so I can't walk	Reduced exercise: impairment	1	221
And I also go walking… I drive out there and I walk the woods. … Because I enjoy it	Pleasure	2	766
I always go to town ...I perhaps go out at half past nine, and it's half past one when I get back	Purpose	3	426
So I go in the car to the Park and Ride … walk for ten minutes, … if you feel alright, you do a bit more.	Combine pleasure with purpose	3	587
I like doing things. You know, it can be quite physical, ... I've laid the floor--the floor in the downstairs loo.	Coping: frustration	3	1186

well I haven't done a lot of walking lately … tend to go the block once	Reduced exercise: impairment	4	342
There was a couple of the neighbours wanted to go somewhere or do something… and err… so we did start that.	Friendships	4	440
I used to… like to see how many lengths I could do.	Challenge	1	213
Maintain my independence, keep myself fit, because I've had cancer twice.	Maintaining health	2	321
They [exercises] keep it at bay, they give me… they given me tremendous strength in that leg //	Maintaining health	2	949
it's important that people have got that confidence that their heart's working okay to do that.	Self-efficacy	2	1127
it's company	Seeks company	1	99
I think it's nice to have a bit of social.	Enjoys social slightly more than the exercise	1	105
I had a new knee.	Coping with impairment	1	221
it might loosen it [the arthritic joint] up ((laughter))	health literacy	1	510
they've [all died] ... I have to keep myself-- I don't-- it's me, I have to keep myself fit.	bereavement	2	318
especially after that really bad fall.	Coping with impairment	2	387
my balance … Umm I've got a slipped disc and a slightly bent spine, … walking can be a bit of a problem.	Coping with impairment	2	
If I suddenly across something that's really uphill that I begin to feel breathless… I think it's fibrotic lungs	Coping with impairment	3	1207
the bus drivers are all nice	Combining shopping with exercise	1	97
it's company	enjoys company and fresh air	1	99
I'll go because I like it when I get there" like you know, it… to get the benefit	persistence because of physical benefits	1	516
Some people wouldn't be so motivated I don't think, as me. Perhaps I'm stubborn	Stubbornness versus motivation	1	578
I think you get--I think walking through the woods… is qu--very peaceful.	Pleasure	2	771
R: Do I need to ask if you're going to exercise in the future? P2: Oh yes ((laughter))	Pleasure	2	781
Oh yes I like--I always exercised.	Pleasure	4	326

Appendix K: SF12 Assignment letter



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NON-COMMERCIAL LICENSE AGREEMENT
Office of Grants and Scholarly Research (OGSR)

License Number: QM041584

Licensee Name: Kevin Anthony c/o University of Nottingham (UK Campus)

Licensee Address: 18 Beaumaris Drive, Chilwell, Nottinghamshire NG9 5PB GB

Approved Purpose: Development of an intervention to support Older People's Rehabilitation Exercise Engagement (OPREE).

Study Name: PhD Thesis/Dissertation
Study Type: Non-commercial academic research and/or thesis – Unfunded Student
Data Collection Method: Paper

Therapeutic Area: Wellness & Lifestyle
Indication: Healthy Living

Royalty Fee: None, because this License is granted in support of the non-commercial Approved Purpose

A. Effective Date: This Non-Commercial License Agreement (the "Agreement") from the Office of Grants and Scholarly Research (OGSR) is made by and between OptumInsight Life Sciences, Inc. (f/k/a QualityMetric Incorporated) ("Optum"), 1301 Atwood Ave, Suite 311N, Johnston, RI 02919 and Licensee. This Agreement is entered into as of the date of last signature below and is effective for the Study Term set forth on Appendix B.

B. Appendices: Capitalized terms used in this Agreement shall have the meanings assigned to them in Appendix A and Appendix B. The appendices attached hereto are incorporated into and made a part of this Agreement for all purposes.

C. Grant of License: Subject to the terms of this Agreement, Optum grants to Licensee a non-exclusive, non-transferable, non-sublicensable worldwide license to use, solely for the Approved Purpose and during the Study Term, the Licensed Surveys, Software, SMS Scoring Solution, and all intellectual property rights related thereto ("Survey Materials"), in the authorized Data Collection Method, Modes of Administration, and Approved Languages indicated on Appendix B; and to administer the Licensed Surveys only up to the total number of Administrations (and to make up to such number of exact reproductions of the Licensed Surveys necessary to support such Administrations) in any combination of the specific Licensed Surveys and Approved Languages, Data Collection Method, and Modes of Administration.

EXECUTED by the duly authorized representatives as set forth below.

OptumInsight Life Sciences, Inc.	**Kevin Anthony** (Licensee)
Signature:_____	Signature:_____
Name:_____	Name: KEVIN ANTHONY
Title:_____	Title: MR
Date:_____	Date: 23 JULY 2017

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Appendix L: MITI scoring sheet and instructions

Motivational Interviewing Treatment Integrity (MITI) coding

Background

Motivational interviewing (MI) is a person-centred counselling form where the motivation to change is elicited and strengthened. MI aligns with, but is not the Trans-Theoretical Model. Equally, it is not a means of deceiving people so that they do what you want them to do, nor does it form a dichotomous decisional balance where one either decides to change behaviours or not. Similarly, MI is not representative of normal practice and is therefore not an effortlessly learned skill (Miller and Rollnick, 2009a). As an example of this, the term 'complex reflection' is given to a skilful statement made by the interviewer which reflects the client's dialogue, but adds supplementary or alternative meaning beyond that which was said by the client (Miller and Rollnick, 2013). Various systematic reviews and meta-analyses have shown that MI is effective across behaviours and in different healthcare contexts (Burke et al., 2003, Hettema et al., 2005, Lundahl et al., 2013b).

The two components of MI are that of the so-called MI spirit and the technical component. The former consists of the counsellor's attitude and is categorised by a genuine interest and ability to empathise with the client. By the use of open questions and reflections (for example), the latter consists of the ability to use the techniques of evocation, elicitation, and reinforcement of change talk (Miller and Rose, 2009b). The ability to deliver high quality MI, therefore represents a significant challenge with ensuing variability, and unreliable self-reported MI fidelity (Apodaca and Longabaugh, 2009, Mertens et al., 2016). Therefore a measure of fidelity is essential (Bellg et al., 2004) to ensure the quality of research findings (Knittle, 2014). The Motivational Interviewing Treatment Integrity (MITI)

has been developed for this purpose (Moyers et al., 2005) and independently found to demonstrate good inter-rater reliability (Pierson et al., 2007), and valid (Forsberg et al., 2008). As a clinical reflection tool, MITI was shown to be have the ability to endorse and improve clinical and research MI delivery (Forsberg et al., 2007). Notably, Forsberg and colleagues expressed concern that MITI lacked the ability to assess global variables such as empathy and MI-spirit where the tool's inter-rater reliability of the tool demonstrated that, whilst open / closed questions and the sum of reflections yielded fairly high Intra Class correlation (an inferential statistic that defines the strength by which units in the same group resemble one another), the remainder of the domains did not exceed 0.70. Acknowledging this, a later amendment aimed to resolve this (Mertens et al., 2016). MITI is therefore appropriate here.

Method of MITI scoring

Global counsellor ratings capture the overall impression of the session and cover evocation, collaboration, autonomy/support, direction, and empathy. A five-point scale ranges from 1 (low) to 5 (high) (Moyers et al., 2014).

Evocation				
Low				High
1	2	3	4	5
Clinician actively provides reasons for change, or education about change, in the absence of exploring client's knowledge, efforts or motivation.	Clinician relies on education and information giving at the expense of Exploring client's personal motivations and ideas.	Clinician shows no particular interest in, or awareness of, client's own reasons for change and how change should occur. May provide information or education without tailoring to client circumstances.	Clinician is accepting of client's own reasons for change and ideas about how change should happen when they are offered in interaction. Does not attempt to educate or direct if client resists.	Clinician works proactively to evoke client's own reasons for change and ideas about how change should happen.

Behaviour counts are accounted for by counting verbal behaviour frequency of giving information, MI adherent responses, MI non-adherent responses, question, and reflection.

MI is evaluated by the summary scores and belonging thresholds: percentage of open questions, percentage of complex reflections, percentage of MI adherent responses, and reflections-to-questions ratio.

The beginning proficiency has been calculated to be ≥3.5 (out of 5) for the global spirit and a reflection to question ratio of 1. The percentage of open questions and complex reflections should be ≥ 50 and 40% respectively. MI adherent behaviours should be ≥ 90%.

Empathy and MI non-adherent behaviours represent **successful treatment predictors** and therefore can be checked by checking whether empathy crossed the global counsellor thresholds and counting the amount of MI non-adherent responses.

MITI Scoring table

Global counsellor ratings	Low				High
Evocation (E)	1	2	3	4	5
Collaboration (C)	1	2	3	4	5
Autonomy and support (A/S)	1	2	3	4	5
Direction	1	2	3	4	5
Empathy	1	2	3	4	5

Behaviour counts		No. of counts
Giving information (GI)	Giving information	
MI adherent (MIA)	Asking permission, affirming, empathising, control, support	
MI non-adherent (MINA)	Advise, confront, direct	
Questions	Closed questions (CQ)	
	Open questions (OQ)	
	Total questions (CQ + OQ)	
Reflection	Simple reflection (SR)	
	Complex reflection (CR)	
	Total reflections (SR + CR)	

MITI Summary scores and belonging threshold			
	Calculation	Threshold beginning proficiency	
Global spirit	E + C + A/S / 3	≥3.5	
% open questions	OQ / (OQ + CQ)	50%	
% Complex reflections	CR / Total reflections	1	
Reflections: Questions ratio	Total reflections / total questions	40%	
% MI adherent	MIA / (MIA + MINA)	90%	

Additional MI fidelity measures and belonging thresholds			
	Derived from	Threshold	
Empathy	Global counsellor ratings	≥3.5	
MI non adherent	Behaviour count	As low as possible	

Appendix M: Behaviour Regulation Exercise Questionnaire version 3 domains and statements

Domain	Statement	Low score inference	High score inference
Amotivation	'I don't see why I should have to exercise.' 'I can't see why I should bother exercising.' 'I don't see the point in exercising.' 'I think exercising is a waste of time.'	High levels of exercise motivation.	Low levels of exercise motivation.
Extrinsic regulation	'I exercise because other people say I should.' 'I take part in exercise because my friends/family/partner say I should.' 'I exercise because others will not be pleased with me if I don't.' 'I feel under pressure from my friends/family to exercise.'	Did not exercise for reward.	Exercised for some form of reward such as reduction of falls.
Introjected regulation	'I feel guilty when I don't exercise.' 'I feel ashamed when I miss an exercise session.' 'I feel like a failure when I haven't exercised in a while.' 'I would feel bad about myself if I was not making time to exercise.'	Exercised for personal reasons, not because they felt obliged to do so.	Exercised because they felt obliged to do so.
Identified regulation	'It's important to me to exercise regularly.' 'I value the benefits of exercise.' 'I think it is important to make an effort to exercise regularly.' 'I get restless if I don't exercise regularly.'	Did not value the importance of exercise, and did not embrace the values of exercise engagement.	Appreciated the importance of exercise, but still did not embrace the values of exercise engagement.
Integrated regulation	'I exercise because it is consistent with my life goals'. 'I consider exercise part of my identity.' 'I consider exercise a fundamental part of who I am'. 'I consider exercise consistent with my values'.	Does not identify with exercise engagement values and goals.	Strongly identified with the values and goals of exercise engagement.
Intrinsic regulation	'I exercise because it's fun.' 'I enjoy my exercise sessions'. 'I find exercise a pleasurable activity.' 'I get pleasure and satisfaction from participating in exercise'.	No enjoyment or interest in exercise.	Exercised for enjoyment or interest.

Appendix N: Example of supervisory record

School of Medicine

RECORD OF FORMAL SUPERVISORY MEETING

7th June 2016

NAME OF STUDENT: **Kevin Anthony**

PROJECT title: An intervention to increase Older People's Rehabilitative Exercise Engagement (OPREE).

Principle supervisor:	**Prof Pip Logan**
Additional Supervisor(s):	**Dr Kristian Pollock**
	Prof Tahir Masud
	Dr Veronika Van der Wardt
Date of next meeting:	**18th July 2016**

SUMMARY OF PROGRESS since last recorded meeting (to be completed by the student)

- All participant interviews have been transcribed (12 patient, 2 staff, and 1 focus group). Patient interviews have nearly been subjected to framework analysis. The staff interviews and focus group are yet to be analysed. KA to complete the patient interview analysis and progress the staff interviews. KA to forward data as it becomes available to KP with the plan that a meeting be held to review the data.
- Since the last supervision session, priority has been given to analysis of the interviews. Consequently, although the background and methodology have been further revised, limited progress has been made. A discussion has been held relative to how to progress this. It has been agreed that further work needs to be progressed before the next phase of the project. KA to progress as a matter of urgency. KA to forward text as it becomes available to VvDW.
- KA has identified and attended a recently launched course with the purpose of improving writing skills; this is an ongoing issue which is continually being addressed by KA.
- Self-determination theory is to be embedded within the project: KA to ensure that this is fully justified.
- As suggested, KA has formed a mind map of the project. This was extensively discussed with a view to development project through to completion and beyond.
- A discussion was held relative to the formation of methodology sections and it was agreed that each phase of the project would have its own specific methodology section
- OPREE as a strategy is now being formed. This has arisen from the literature review, systematic review, and interviews. Nevertheless, these are yet to be fully completed: this is now a matter of urgency. It is possible that a minor amendment is required for the ethics committee prior to the full launch of the proof of concept study. KA is to fully review and clarify whether or not an amendment is required.
- A potential external examiner for the final viva was discussed and TM agreed to approach Prof Dawn Skelton.
- PL is in continued discussion with CLAHRC with regards to funding for proof reading

Training Record (details of activities since last supervisory meeting - to be completed by student)

Dates	Course / conference details	Statutory Training Points	Negotiated Training Points	Comments
10 Dec	Getting going on your thesis	2		Attended
Oct - Jan	Quantitative analysis		5	Attended
21 March	SRA course: Managing Focus Groups		2	Attended
10 Feb	BPS conference: Ageing in Place		1	Attended
3 Mar	Using NViVO		2	Attended
26 April & 3 May	Introduction to quantitative analysis	4		Attended
4 May & 11 May	Basic statistics with SPSS	3		Attended
2nd June	Crafting a chapter of your thesis	1		Attended
4th & 5th July	Motivational interviewing		4	Booked
9th June	understanding your environment: horizon scanning and scenario planning	1		Booked
10th June	Writing an abstract	0	0	Booked
	Accumulated points from year 1	15	14	
	Accumulated points from year 2	10	10	
	Total points			

Supervisor's Report (Brief details of any problems and how they have been resolved. Detailed information is required only if student progress is unsatisfactory):

PLAN OF ACTION until next recorded supervisory meeting (to be briefly itemised by student, discussed with and approved by, supervisor)

Complete interview analysis
Revise the systematic review results section.

Student's concerns/problems/comments:

Signed: ..... (Supervisor) Date: 18/7/16.

Signed: ..... (Supervisor) Date: 18.7.2016

Signed: ..... (Supervisor) Date: 18/7/2016

Signed: ..... (Supervisor) Date: 18/7/2016

Signed: ..... (Student) Date: .....

Once signed, a copy should be retained by the student in their student handbook for audit purposes. The original should be retained by the supervisor. Forms must be available for monitoring/appeals purposes if required.

*** UoN Quality Manual defines a 'supervision meeting' as involving simultaneous contact between student and supervisor(s), either face-to-face, by Skype, Video Conference or other packages. In exceptional circumstances where meetings are not feasible, contact should be maintained, for example by telephone or email. It is important that the student's progress to date and the future direction of their research is discussed.**